

BULLETIN

of the

American Association of Petroleum Geologists

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BULLETIN

of the

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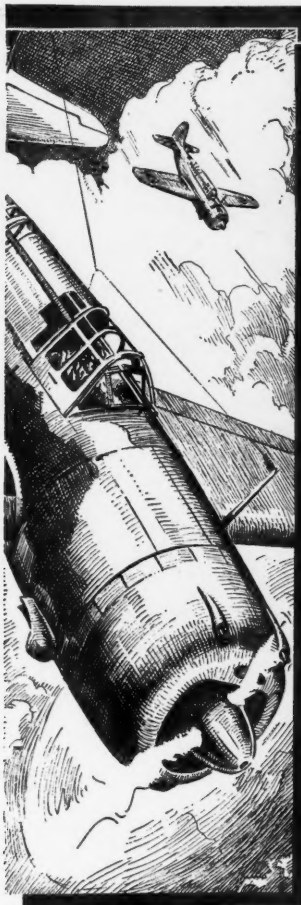
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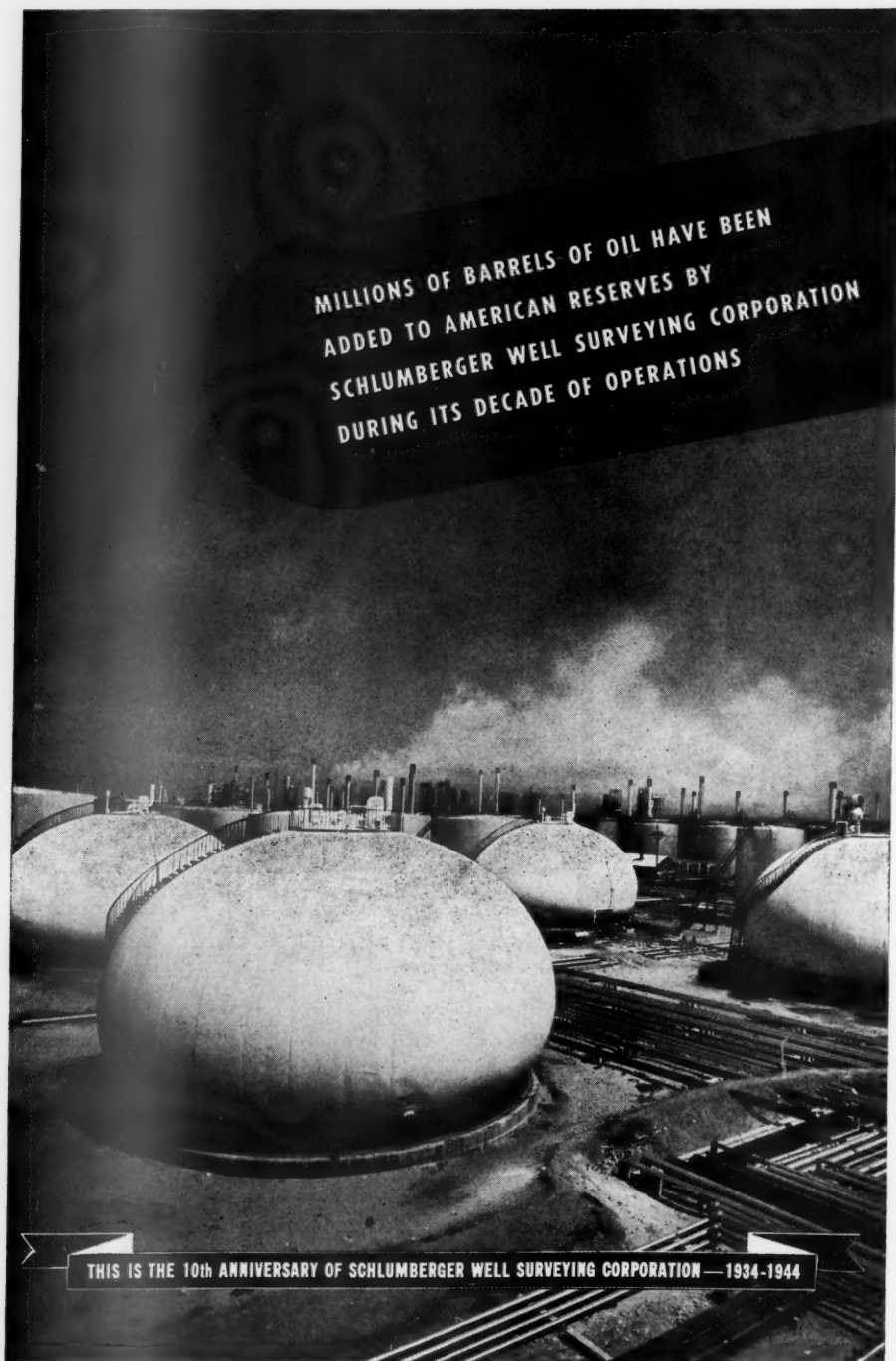
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BULLETIN
of the
AMERICAN ASSOCIATION OF
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JUNE, 1944

CLASSIFICATION OF EXPLORATORY DRILLING
AND STATISTICS FOR 1943¹

FREDERIC H. LAHEE²

Dallas, Texas

ABSTRACT

A serious need of the petroleum industry is standardization of the definitions and classification of exploratory wells, for only upon a generally accepted nomenclature can satisfactory estimates be made of the exploratory effort in the search for new oil and gas reserves. After much discussion and correspondence, we have prepared a statement of definitions and a classification of exploratory holes which, we hope, will prove to be suitable for general use. This topic is treated in Part II of the present report, where numerous explanatory comments are included.

In Part III is our review of exploratory drilling in 1943. This year we are following the proposed classification (Part II) in referring to "exploratory holes," a term which, however, is analogous to the word "wildcats," as used in our earlier reports on this subject. On this basis, in 1943, 3,843 exploratory holes were drilled as contrasted with 3,212 holes drilled in 1942. The total exploratory footage drilled in 1943 was 15,122,364 feet as against 12,123,994 feet in 1942. The average depth of hole increased from 3,775 feet in 1942 to 3,935 feet in 1943, for all states covered; and from 4,647 feet to 4,968 feet in the southern states. Again, we have compiled figures on exploratory drilling and on estimated proved reserves in the eleven states of Arkansas, California, Illinois, Indiana, Kansas, Louisiana, Michigan, Mississippi, New Mexico, Oklahoma, and Texas.

From all points of view, as brought out by these statistics, the exploratory effort must be still further stepped up during 1944.

PART I. INTRODUCTION

In the search for new crude-oil supplies and in the effort to make substantial additions to partly developed pools, holes³ are drilled either at random or, more commonly in these modern times, on the basis of technical information (geological, geophysical, or both) which is never complete. Such holes are referred to as "exploratory." They do not include holes drilled within the limits of a developed pool, or of the developed part of a pool, where such drilling is carried down *only* to the known producing formation (or formations) of this pool. Holes of this latter class are commonly known as "field wells."

¹ Presented before the Association at Dallas, March 23, 1944. Manuscript received, April 6, 1944.

² Chief geologist, Sun Oil Company.

³ Although "well" is better used for a hole that has been completed as a producer, in the present paper we are using *hole* and *well* synonymously, in conformity with general practice. In some parts of this paper "test" is used for a hole not completed as a producer.

There are several types of hole of the former class, all of which are exploratory, but in varying degrees. For example, (a) there are holes which are drilled on geologic structures or in areas which have never before produced oil. (b) There are holes which are drilled on producing structures, but completely outside of the then known limits of any pools previously developed on such structures. And (c) there are holes which, although drilled within the then known boundaries of a producing pool, are carried on down to greater depths to explore for unknown possibilities below the deepest producing formation of this pool.

In our reports of the last 4 years, covering information for 1939, 1940, 1941, and 1942,⁴ we have included these types of exploratory hole under the general category of wildcats, but, in the original statistics from which the tabular data were compiled, we listed holes of type *a* as "rank wildcats" and holes of types *b* and *c* as "semi-wildcats." Previous to 1939⁵ our figures omitted "semi-wildcats" of type *c*, a very small group in those days. We want especially to make these points clear because recently, in his article on wildcat drilling,⁶ W. V. Howard has stated that "Lahee's definition of a wildcat has become successively liberalized so that the increase" [in annual number of wildcats reported as drilled] "may represent wells added as a result of this liberalization." For the years 1939 to 1942 inclusive, the same basis was used and accordingly the data presented for these years may be compared, with assurance that they are essentially analogous. Before 1939 there were some minor changes in our approach with the result that the totals may not be as closely comparable, but even here the variations amount to probably less than 5 per cent. Another point which may well be stressed in this connection is the fact that a large proportion of the statistics which have been used in these reports⁷ was collected and compiled by the same geologists from year to year, thus lessening the chance for variation in definitions due to the personal equation. In other words, we believe that our data on wildcatting, as published by the American Association of Petroleum Geologists in recent years, and certainly within the last 4 years, are comparable from year to year, and that they do illustrate, within a very small percentage of error, the trend of exploratory effort in the states covered.

With reference to exploratory statistics submitted by different organizations, it is true that there are unfortunate discrepancies. One can not safely compare the figures compiled under different auspices, and it is mainly for this reason that standardization of terms and classifications used in these studies is a necessity. Toward this end we have prepared, and we herewith present as Part II of this paper, a classification of exploratory drilling, which we hope will be acceptable

⁴ See this *Bulletin*, Vol. 24, pp. 953-58; Vol. 25, pp. 997-1003, 1938, 1939; Vol. 26, pp. 969-82; and Vol. 27, pp. 715-729.

⁵ This *Bulletin*, Vol. 21, pp. 1079-82; Vol. 22, pp. 645-48, 1231-36; Vol. 23, pp. 789-94.

⁶ "Wildcat Drilling Has Failed to Keep Up with Increasing Need of Discoveries," *Oil and Gas Jour.* (February 17, 1944), pp. 41, 42.

⁷ For 1939-42, as previously cited.

for general adoption by the industry.^{7a} This classification and the accompanying definitions are the outcome of a voluminous correspondence and of many conferences with other geologists and petroleum engineers in various parts of the country.⁸ They represent the result of repeated criticisms, suggestions, and revisions, until, as nearly as seems feasible, the variable factors that apply in different districts and under different conditions have been covered. The classification is intentionally broad so that it can be applied in any region. We have tried to steer away from being too specific as to details. If this classification does not seem exactly to fit the conditions in your local district, bear in mind that the endeavor has been so to construct it that it will cover all districts. Its practical value rests on its general applicability and not so much on an itemization of innumerable minor factors.

One more word before presenting this classification: we earnestly believe—and in this a large majority of geologists, whom we have questioned, agree—that the main criterion for defining a wildcat should continue to be the degree of risk of failure involved in the drilling, the degree of hazard in the venture. And we believe that this criterion should be applied in classifying different types of exploratory holes. It is important to realize that the degree of risk depends primarily on how much is known and how much is unknown of the underground geological conditions at and near the site of the hole. As we indicated in our earlier definition of a wildcat,⁹ *distance* is a less significant factor, which can not be stipulated as so many feet, or so many miles. Therefore, it is our conviction that logical classification of exploratory holes properly requires the judgment of a geologist.

PART II. CLASSIFICATION OF EXPLORATORY DRILLING FOR PETROLEUM

A. DEFINITIONS¹⁰

1. *Petroleum defined.*

For statistical purposes, as discussed in Part II of this paper, *petroleum* is defined as including crude oil, natural hydrocarbon gas, and the condensate content of natural gas, wherever these occur under natural conditions.

2. *Occurrence of petroleum.*

(a) A *pool*, as used in the following discussion, is an underground accumulation of petroleum in a single and separate natural reservoir (ordinarily a porous sand-

^{7a} This classification was accepted by the Petroleum Administration for War and by the Petroleum Industry War Council on May 2, 1944.

⁸ We are grateful, for constructive criticism, to G. C. Gester, A. I. Gregersen, Wm. B. Heroy, Graham Moody, R. J. Schilthuis, Carleton D. Speed, E. G. Trostel; and especially to Paul Weaver, Leonard Orynski, Phil Martyn, and Sidney Judson, all members of P. A. W. Subcommittee on Exploration for District 3.

⁹ See this *Bulletin*, Vol. 27, p. 717 (June, 1943).

¹⁰ The definitions given in this paper are for the purpose of reporting exploratory drilling, and are not to be construed as legal definitions.

stone or limestone). It is characterized by a single natural-pressure system so that production of petroleum from one part of the pool affects the reservoir pressure throughout its extent. In all directions a pool is so bounded by geologic barriers (such as impermeable strata, geologic structural conditions, and water in the rock formations) that it is effectively separated from any other pools that may be present in the same district, or on the same geologic structure.

(b) A *field* may be a single pool, or it may consist of two or more pools, all on, or related to, the same geologic structure. Where there is more than one pool in the same field, the several pools are separated from one another through geologic causes such as synclinal conditions, faulting, pinching-out of reservoir beds, and changes in porosity and permeability. The pools may occur at several horizons of different geologic age, separated by relatively impervious strata, and in such cases they may directly, or only partly, overlap one another in a horizontal sense; or they may not overlap at all.

Comment.—The terms “pool” and “field” are applied herein only where they are capable of producing oil or gas in *substantial* quantities, which, in most cases, means in commercial quantities. These terms are not intended to cover slight accumulations from which nothing but very small showings can be obtained. (See comments on “discovery” under 5(c).)

Though a field may include several pools which, by definition, must all be on, or related to, the same geologic structure, the reverse may not be true. In other words, all the pools on one major structure do not necessarily constitute *one* field. If the structure is large, several fields may be located on it.

3. Classification of drilling.

(a) *Development drilling*, in the petroleum industry, is the drilling of wells within, or close to, the limits of a producing (or producible) pool, as these limits are known at the time of this drilling, the object being to complete such wells in the “pay horizon” (sand, limestone, *et cetera*) of the pool.

Comment.—The word “producible” is added in parentheses here, and elsewhere in this report, to cover the case of a pool, which, temporarily, may not be producing because its well or wells are shut in.

Development drilling is mentioned in this paper mainly for contrast with exploratory drilling.

(b) *Exploratory drilling* is (1) the drilling of wells relatively a considerable distance outside the limits of developed, or developing, pools as these limits are known at the time of such drilling; or (2) the drilling of wells within the then known limits of a pool with the object of searching for new producible formations *above* or *below* the producing (or producible) formation of the pool; or, if there are two or more superposed pools in the field, above or below the producing (or producible) formation of the *deepest* pool penetrated by this well.

Comment.—For a discussion of this subject see (b) (3), (p. 706).

4. Classification of wells at time of commencement of drilling.

(a) Under the head of *development drilling* may be listed *field wells*.

A *field well* is a well drilled with the object of further exploiting the "pay horizon" of a pool *within the area which has already been essentially proved for production in this pool*. Such a well may be inside the pool as already outlined by producing (or producible) wells, or it may be a relatively short distance outside these limits.

Comments.—Under this definition an edge well, that is, a well knowingly drilled close to the recognized productive boundary of a pool, is a "field well," and this is true whether this edge well is completed as a producer (within the pool) or is abandoned as a dry hole (just outside the boundary of the pool).

After discovery of a new pool (or a new field), the second well, and subsequent wells, should all be called field wells if they meet the requirements of the definition as above stated.

"Field well" may be applied to a well within a field consisting of a single pool; or in a field consisting of two or more pools, but in the latter case the objective must be the producing formation of that pool within the boundaries of which, or close to the boundaries of which, this well is located.

On a structure of moderate relief, where the producing formation blankets the entire structure, and where through subsurface mapping the contours on this formation can be mapped with a fair degree of correctness, a hole drilled on an undeveloped part of the structure, but considerably above edgewater level, may be called a field well, because its chances of production are very good. Note that in this case the underground conditions are definitely known as contrasted with what is known affecting an outpost well (described later).

(b) Under the heading of *exploratory drilling* we may list these classes of wells: *wildcat wells* (including new-field wildcats and new-pool wildcats), *outpost wells*, *deeper-pool tests*, and *shallower-pool tests*.

(1) A *wildcat well* (or simply *wildcat*) is a well located relatively a considerable distance outside the limits of producing (or producible) pools as these limits are known at the time of its drilling. A *new-field wildcat* is a hole drilled on a geologic structure or in a geologic environment where petroleum has not yet been discovered. A *new-pool wildcat* is a hole drilled on a structure, or in a geologic environment, where other pools have been found, but where the complexities in the underground geologic conditions are so great that searching for a new pool is very hazardous. As suggested in these names, the objective of a new-field wildcat is discovery of a new field, and the objective of a new-pool wildcat is discovery of a new pool in a field already discovered. (See "Comments" following the next paragraph.)

(2) An *outpost well* (or *outpost*) is a hole drilled with the thought that it will probably extend, by a considerable distance, a pool already partly developed. Its original objective is the producing formation of this pool, although it may be completed or abandoned at a higher, or at a lower, stratigraphic horizon. It is

far enough from the limits of the pool, as known at the time when its drilling is started, to make its outcome uncertain, but it is not far enough from these limits to be designated a wildcat. If it is successful in its original object, it will add materially to the productive area of the pool. It may be dry.

Comments.—As we have pointed out before, the element of risk of failure to find oil is an important factor in classifying wildcats and outposts. Therefore, where geological conditions are simple and easy to anticipate and where, for this reason, a well is likely to find production, the *distance* of a wildcat measured from the known limits of the nearest pool (not from any other *drilling* well), will be greater than where geological conditions are complicated and failure is not unlikely. Where pools are known to be large and geological conditions simple, a hole located two or three miles from the nearest productive area may be classed as an outpost. Where conditions are complicated, as on a salt dome, or in an area characterized by faulting or by lensing or shaling sands, a hole drilled just outside the *known actual edge* of a pool, and on the same structure as that on which this pool is located, is essentially a wildcat, for it is exploring for unknown possibilities under complex geological conditions. On the other hand, if a hole is drilled along strike several locations from production on a salt dome, it may better be called an outpost, unless faulting is believed too greatly to diminish the chance of extending the known producing area in that direction.

Obviously the definition of wildcat or outpost must be applied when a hole is started and not after its completion. For example, nothing learned during the drilling of a wildcat nor after its completion or abandonment can alter the degree of risk which was taken in the original venture of locating and drilling the hole. If two holes are started as wildcats in the same area, they are still wildcats, even if one of them happens to discover production before the other is completed.

(3) A *deeper-pool test* is a well located *within the known limits of a pool* and drilled with the object of searching for new producible formations *below* the producing (or producible) formation of the pool; or, if there are two or more overlapping pools, *below* the producing (or producible) formation of the *deepest* pool penetrated by this well.

Comment.—In nearly all cases “below,” as used in this definition, means both “stratigraphically below” and “at a greater depth”; but under very rare conditions, such as overthrust faulting, the producing formation of the pool might be stratigraphically older, though shallower, than the deeper prospects sought in the “deeper-pool test.”

Under certain conditions of complicated geology, within a field that includes two or more pools at different stratigraphic levels and not superposed one above another, “deeper-pool test” may be applied to a hole located within the producing area of a higher pool, but considerably outside the producing area of a lower pool, if the objective of this well is below the pay zone of the pool within which it is located. For this classification such a hole should be far enough from the edge of the deeper pool to be designated a wildcat if there were no higher pool.

There has been much question about how to discriminate between (1) a well drilled from the surface with the object of searching for unknown prospects below the deepest known pay zone penetrated by the well, and finally completed as the discovery well of a new deep pool, or abandoned *at its total depth* as a dry deeper-pool test; (2) a well similarly drilled but, after failing to discover deep oil, plugged back and completed in the pay zone of the deepest pool within the confines of which it was located; and (3) a field well which, after producing for some time (days, months, or years) from the known pay of the pool, has then been deepened to explore underlying unknown possibilities. In order to simplify the statistical study of these three varieties of hole, we list all as *deeper-pool tests*—but in each case we assign as *exploratory footage* only the footage below the pay zone of the *deepest* previously known pool penetrated by this well.

(4) A *shallower-pool test* is a well located within the known limits of a pool and drilled with the object of searching for new producible horizons *above* the producing (or producible) formation of the pool; or, if there are two or more overlapping pools at the site of the well, *above* the *deepest* of these pools.

Comments.—Wildcats—both those exploring for new fields and those exploring for new pools—are holes drilled considerably *outside* the limits of producing areas, *in a lateral sense*, that is, as would be obvious on a map. On the other hand, deeper-pool tests and shallower-pool tests are exploratory *in a vertical sense* since they are drilled to search for deeper or shallower new pools respectively above or below a known and partly or wholly developed pool. It is true that a shallower-pool test penetrates a stratigraphic section at least partly known, but it is definitely exploring for petroleum and commonly for structure. Our reason for relating both the shallower-pool and deeper-pool tests to the *deepest* producing formation in an area of two or more superposed pools is that this greatly simplifies the definition. It is much better to do this than to attempt to discriminate between such tests which might be exploring at various levels where there are several overlapping pools in one field.

5. Results of drilling.

As results of drilling we may designate wells as *dry holes*, as *extension wells*, or as *discovery wells*.

(a) Any hole—even a well drilled within the known boundaries of a pool as a “field well”—may be abandoned as *dry*. However, the chances are that field wells will produce, or be producible; and although the risk is greater, outpost wells have a fair chance of success; but wildcats, according to statistics, have less than one chance in five or six of discovering oil or gas “in substantial quantities.”

(b) Any well which is located as an outpost well or as a wildcat will be classified as an *extension well* (as a result of its drilling), if it extends the productive (or producible) area of a pool (Table I); but this classification can not logically be applied until after the fact is demonstrated, and such demonstration may require the drilling of several intermediate wells.

(c) Any wildcat, outpost, deeper-pool test, or shallower-pool test, which discovers a new pool of petroleum,¹¹ is a *discovery well*.

Comments.—Discovery, then, as applied to oil and gas, is the finding of a previously unknown or unproved *pool* of petroleum. For the first pool on a geologic structure we may speak of discovery of a pool or discovery of a field, since this first pool may also be called a field; but where there are several pools in one field, there can be only one field-discovery well on this structure, that is, the well that was completed as a producer in the first pool found. Thereafter the wells discovering new pools on this same structure are pool-discovery wells; they are not field-discovery wells.

In some places a wildcat, drilled some distance from production, is at first erroneously credited with discovery of a new pool. Subsequently, through the drilling of additional wells, it is shown to be an extension well of a pool previously known. Such a well, although it must obviously be removed from the category of discovery wells when the fact is proved, is nevertheless due full credit as a wildcat, based on factors of distance and risk at the time its drilling was undertaken.

It commonly happens that the discovery well on a structure, or a well drilled subsequently in the course of development of the field, penetrates more than one formation which is capable of producing oil or gas in substantial quantities. Generally the well will be completed in only a single formation. If the well is the discovery well of the field, the formation in which it is completed thus becomes the initial pool of the field. Other potentially productive formations penetrated, either above or below the formation in which the well was completed, would not be considered technically as "discovered" until a well has been completed as a producer from each of them. Even if the evidence of the presence of petroleum in such a formation were practically conclusive, a well producing, or so completed that it could produce, from this formation would be required to constitute a new discovery. This distinction is essential even though, from the interpretation of electrical logs, from core samples, and even from drill-stem tests, it may seem almost certain that the formation is capable of production. If the discovery well of a field were completed and producible from two formations, such a dual completion would, of course, be the discovery well of two pools. The discovery well of a new pool or "pay zone" is, accordingly, not necessarily the first well that penetrated the "pay zone" and found evidence of petroleum in it, but the first well to produce substantial quantities of oil or gas from it.

(d) The *date of discovery* of a pool is the date on which the discovery well of the pool is completed as a producer of petroleum. For a field this would be the date of discovery of the first pool in the field. If the first well completed in a pool happened to be in the gas cap of an oil pool, this would still be the discovery well of the pool as a whole, including both gas and oil.

¹¹ See foregoing definitions of "pool" and "petroleum."

B. STATISTICS ON EXPLORATORY DRILLING

In order that the statistics of exploratory drilling may be as consistent as possible between different areas and in order that those in successive years may be as nearly comparable as possible, the foregoing definitions have been suggested for general adoption. In applying these definitions there is bound to be some question in a few border-line cases, but for the most part classification should be made without difficulty.

Table I is a summary presentation of the classifications described in the fore-

TABLE I
CLASSIFICATION OF EXPLORATORY WELLS

		CLASSIFICATION WHEN DRILLING IS STARTED		CLASSIFICATION AFTER COMPLETION OR ABANDONMENT	
		A	B	C	
DRILLING FOR EXTENSION OF PARTLY DEVELOPED POOL.		1	1	1	
		OUTPOST	EXTENSION WELL (SOMETIMES A NEW-POOL DISCOVERY WELL)	DRY OUTPOST WELL	
DRILLING FOR A NEW POOL ON A STRUCTURE OR IN A GEOLOGIC ENVIRONMENT ALREADY PRODUCTIVE.	NEW-POOL TESTS	2a	2a	2a	
		SHALLOWER-POOL TEST	SHALLOWER-POOL DISCOVERY WELL	DRY SHALLOWER-POOL TEST	
		2b	2b	2b	
	DRILLING WITHIN LIMITS OF AREA OF POOL.	DEEPER-POOL TEST	DEEPER-POOL DISCOVERY WELL	DRY DEEPER-POOL TEST	
		2c	2c	2c	
		NEW-POOL WILDCAT	NEW-POOL DISCOVERY WILDCAT	DRY NEW-POOL WILDCAT	
DRILLING FOR A NEW FIELD (I.E., ON A STRUCTURE OR IN A GEOLOGIC ENVIRONMENT NEVER BEFORE DEVELOPED).	FOR NEW POOL ABOVE DEEPEST POOL.	3	3	3	
		NEW-FIELD WILDCAT	NEW-FIELD DISCOVERY WILDCAT	DRY NEW-FIELD WILDCAT	

going pages. To some extent it is briefly explanatory. By following its designations, statistics can be recorded in several ways. Table II is a suggestion for tabulating statistics. In it the main columns correspond with groups 1, 2a, 2b, 2c, and 3 in Table I. Under each of these are three subheadings, "successful," "failure" and "total." (The first two could be headed "producer" and "dry," if preferred.) Under "successful," the kind of producer (oil, gas, or condensate) is indicated, and in this column under each major heading, may be shown the fact whether the producer was a discovery well or an extension well (as proved by the drilling) by the letters "d" and "e," respectively, against the recorded data. As for these data, the number of holes or the exploratory footage, or both, can be shown.

Attention is again called to the differences between sections 4 and 5 in the foregoing text. Bear in mind that preliminary classification is based on the degree

TABLE II
TABULATION OF STATISTICS ON EXPLORATORY WELLS

STATE OR DISTRICT	NEW-POOL TESTS												3	NEW-FIELD WILDCATS						TOTAL EXPLORATORY WELLS DISTRICT OR STATE								
	1			2						2c				NEW-POOL WILDCATS			NEW-FIELD WILDCATS			TOTAL EXPLORATORY WELLS DISTRICT OR STATE								
	OUTPOST WELLS			SHALLOWER-POOL TESTS			DEEPER-POOL TESTS			2c				NEW-POOL WILDCATS			NEW-FIELD WILDCATS			TOTAL EXPLORATORY WELLS DISTRICT OR STATE								
	SUCCESSFUL			FAILURE			TOTAL			SUCCESSFUL				FAILURE			TOTAL			SUCCESSFUL			FAILURE			TOTAL		
	OIL	GAS	COND.	OIL	GAS	COND.	OIL	GAS	COND.	OIL	GAS	COND.		OIL	GAS	COND.	OIL	GAS	COND.	OIL	GAS	COND.	OIL	GAS	COND.	OIL	GAS	COND.

of risk of failure as estimated when drilling of the hole is commenced, and this risk is contingent on how much is known of underground geological conditions when drilling is started. Also remember that preliminary classification of a well, made before the well is completed, can not logically include reference to discovery or extension. Thus, classifications under column A in Table I are fixed and must not be changed. On the other hand, classifications under column B may have to be changed as more information becomes available.

In compiling statistics for study of both the exploratory effort and the results of this effort, all five types of exploratory holes should be separately treated. We refer to the types labeled 1, 2a, 2b, 2c, and 3 in Table I. Unless the data are thus broken down, misinterpretations of the tabulated statistics are inevitable. Furthermore, when thus broken down, the data can then be combined by each statistician according to his own purpose in studying these data. For example, if his object is merely to classify newly discovered reserves, he can group under headings 1, 2, and 3, all three subclasses of 2 being combined (see Table II). Or he can group the data under outposts (1), tests exploring above or below known pools (2a plus 2b), and wildcats (2c plus 3). For purposes of measuring the exploratory effort, especially from the technical point of view, there is a real significance in considering both groups of wildcats (2c and 3) together.

To each wildcat, shallower-pool test, and outpost well, its total footage is to be assigned and listed; but, as already explained, each deeper-pool test is to be credited with only that footage which was drilled below the "pay zone" of the deepest pool within the limits of which it was drilled. In no case should footage penetrated in sidetracking, or in redrilling of a lost hole, be included in the total footage of any hole.

A hole temporarily abandoned should not be listed in one year's record, and then again in succeeding years, each time it is drilled a little deeper. As far as can be determined, it should be listed only when it has been permanently abandoned. Where, after a long lapse of time, a hole recorded as permanently abandoned, is cleaned out and drilled deeper, it should be so designated as an exception in the later listing, and only the additional footage drilled should be assigned to it as of the year during which it was thus deepened.

PART III. STATISTICS ON EXPLORATORY DRILLING IN 1943¹²

Except where otherwise designated, the statistics recorded in Part III of this paper are similar to those used in our reports for 1939 to 1942 inclusive. In other words, we include wildcats (both new-field wildcats and new-pool wildcats),

¹² For the kind assistance and coöperation of the following gentlemen, the writer is especially grateful: A. P. Allison, A. H. Bell, J. E. Billingsley, Kendall E. Born, D. H. Cardwell, R. J. Cullen, M. H. Funk, G. C. Gester, D. C. Harrell, P. Hastings Keller, Edward A. Koester, Chas. S. Lavington, Geo. D. Lindberg, A. M. Lloyd, W. S. McCabe, Graham B. Moody, D. J. Munroe, Geo. W. Myers, Jack A. Parker, Chas. H. Row, Glenn C. Sleight, Lee C. Smith, W. T. Teare, Paul Weaver, and E. B. Wilson.

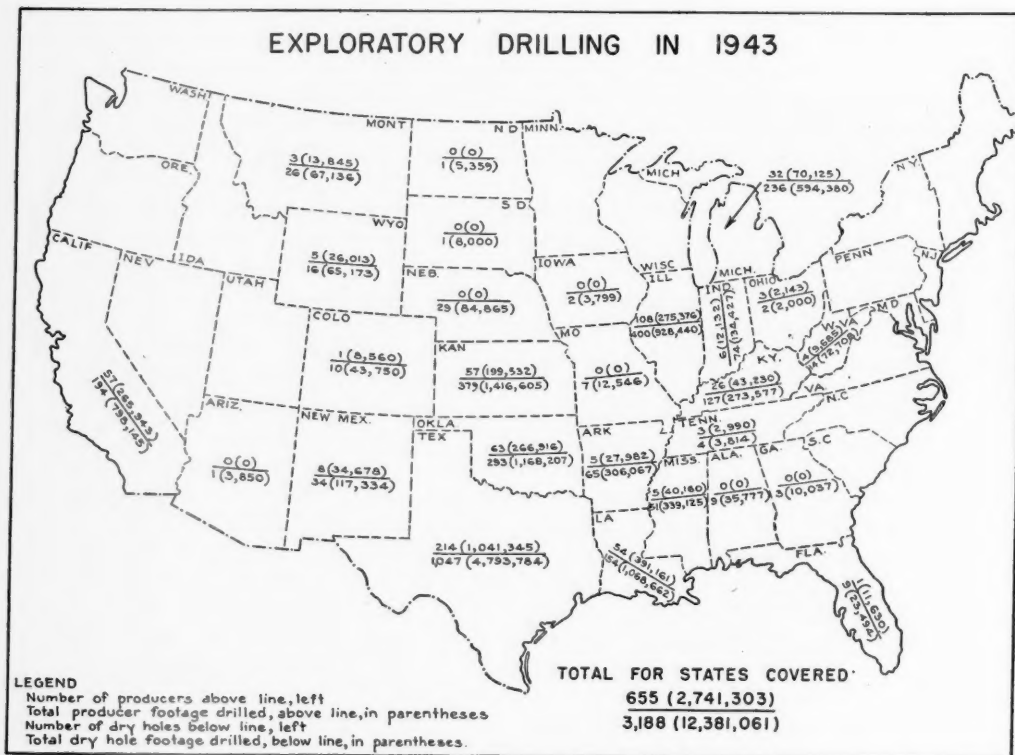


FIG. 1

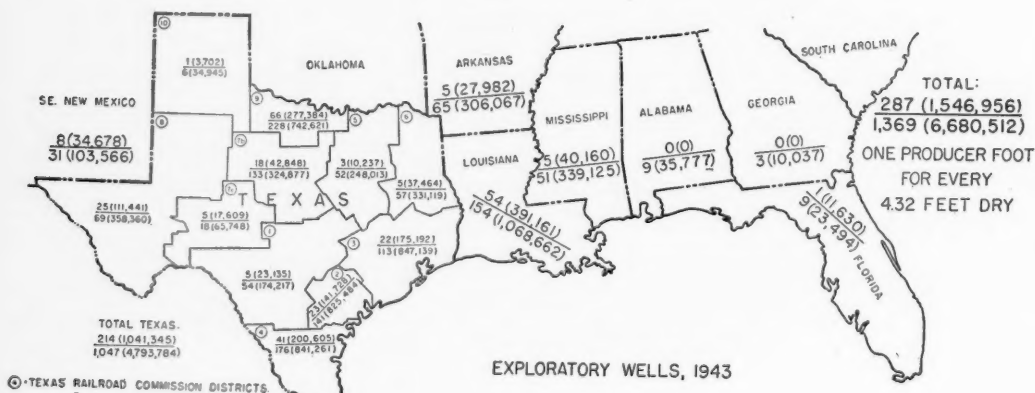


FIG. 2

outpost wells, and deeper-pool tests. For the first two groups we use the total footage drilled in each hole, whether a producer or a dry hole, but in the case of the deeper-pool tests we include only the footage drilled below the deepest producing formation penetrated by the well. These 1943 figures may be consistently compared with those published in our reports of 1939 to 1942.¹³

On the maps (Figs. 1 and 2), numbers in parentheses indicate total footage drilled; figures preceding parentheses indicate the number of holes drilled; figures above the cross line are for producing wells, that is, oil, oil and gas, distillate and gas, and gas; and figures below the cross line are for dry holes.

In the states covered in this review, as shown in Figure 1, and listed in Table III, during 1943 a total of 15,122,364 feet was drilled in 3,843 exploratory holes, divided as follows.

	<i>Feet</i>
655 producers.....	2,741,303
3,188 dry holes.....	12,381,061

This means that 17.0 per cent of the holes drilled, and 18.1 per cent of the footage drilled were successful in 1943. One producer foot was drilled for every 4.51 feet of dry hole. One successful well was drilled for every 4.88 dry holes. The average depth of hole was 3,935 feet.

In the southern states district (Fig. 2), in 1943, a total of 8,227,468 feet was drilled in 1,656 holes, divided as follows.

	<i>Feet</i>
287 producers.....	1,546,956
1,369 dry holes.....	6,680,512

In this area, then, 17.3 per cent of the holes drilled, and 18.8 per cent of the footage drilled were successful. One producer foot was drilled for every 4.32 feet of dry hole. One successful well was drilled for every 4.73 dry holes. The average depth of hole was 4,968 feet. For comparison with statistics for this same area in 1938, 1939, 1940, 1941, and 1942, see Table IV.

Selection of the location for a wildcat well may be based on geology (surface geology, subsurface geology, trend along known structural or stratigraphic conditions, local or regional, or shallow exploratory drilling); or it may be based on geophysics (exploration by seismograph, torsion balance, gravity meter, magnetometer, *et cetera*); or it may be based on some non-technical suggestion or requirement, such as "creekology," "hunch," "doodlebug," promotion, lease obligation, reported showing of oil or gas in holes previously drilled, *et cetera*. In many cases the reason for choosing the location can not be ascertained.

In Table V are listed the reasons for drilling the exploratory holes in 1943, using the best information available from men familiar with such statistics, each in his own state or district. According to these figures, 626 exploratory holes drilled

¹³ *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 24, pp. 953-58; Vol. 25, pp. 997-1003, 1938, 1939; Vol. 26, pp. 969-82; and Vol. 27, pp. 715-29.

on technical advice (geology and/or geophysics) were successful (oil or gas), and 2,616 were dry; 23 holes, located for non-technical reasons, were producers, and 500 were dry; 6 producers and 72 dry holes were located for reasons unknown.

STATISTICS ON EXPLORATORY DRILLING AND PROVED OIL RESERVES
IN AREA OF ELEVEN STATES

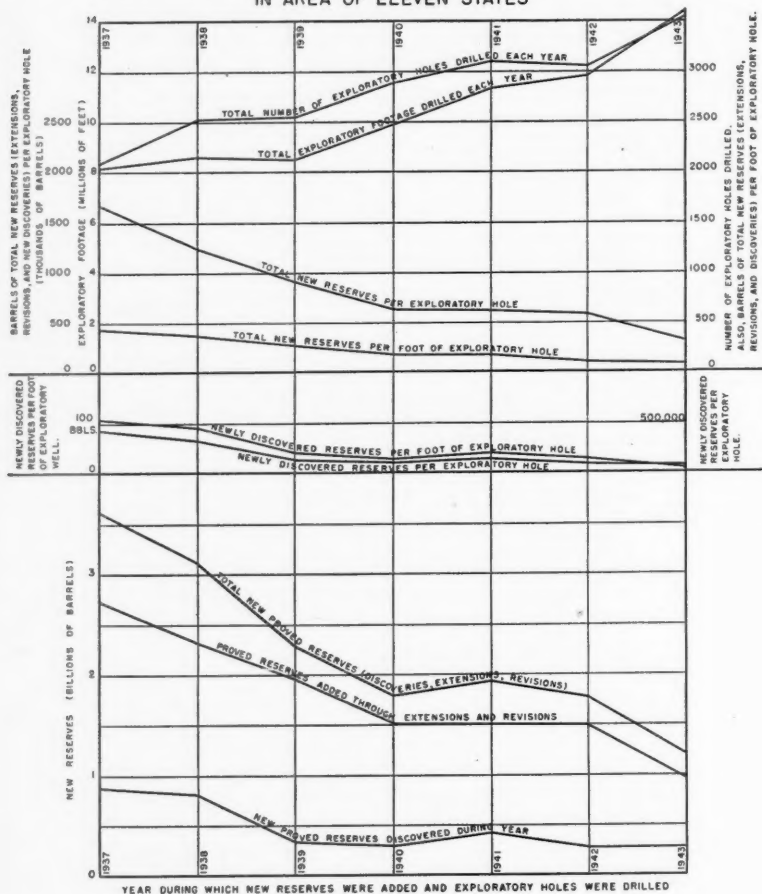


FIG. 3

These figures show that 19.3 per cent of the holes drilled on technical advice were producers as contrasted with 4.4 per cent successful in the case of the holes located without technical advice. Therefore, in 1943, locations based on technical recommendations were nearly 4.4 times as successful as those drilled without

TABLE III. NUMBER OF OIL WELLS, GAS WELLS, AND DRY HOLES DRILLED AS EXPLORATORY TESTS IN 1943

States	Oil Producers		Gas Producers*		Dry		Total Number of Holes	Total Footage Drilled	Average Depth of Hole in Feet†
	Number of Holes	Footage Drilled	Number of Holes	Footage Drilled	Number of Holes	Footage Drilled			
Alabama	0	0	0	0	9	35,777	9	35,777	
Arizona	0	0	0	0	1	3,850	1	3,850	
Arkansas	5	27,982	0	0	65	306,067	70	334,049	4,772
California	44	107,965	13	67,978	104	798,145	251	1,064,088	4,239
Colorado	0	0	1	8,560	10	43,750	11	52,310	
Florida	1	11,630	0	0	9	23,494	10	35,124	
Georgia	0	0	0	0	3	10,037	3	10,037	
Illinois	107	274,255	1	1,121	400	928,440	508	1,203,816	2,369
Indiana	6	12,132	0	0	74	134,427	80	146,559	1,832
Iowa	0	0	0	0	2	3,799	2	3,799	
Kansas	56	108,266	1	1,266	379	1,416,005	430	1,616,137	3,707
Kentucky (W)	25	42,440	1	790	127	273,577	153	316,807	2,071
Louisiana	30	180,245	24	210,916	154	1,068,662	208	1,459,823	7,018
Michigan	24	60,223	8	9,902	236	594,380	268	664,595	2,479
Mississippi	5	40,160	0	0	51	330,125	56	379,285	6,773
Missouri	0	0	0	0	7	12,546	7	12,546	
Montana	1	6,040	2	7,805	26	67,136	29	80,981	2,792
Nebraska	0	0	0	0	29	84,865	29	84,865	2,926
New Mexico	7	25,086	1	9,592	34	117,334	42	152,012	3,619
North Dakota	0	0	0	664	1	5,359	1	5,359	
Ohio (NW)	1	1,479	2	53,604	2	2,000	5	4,143	
Oklahoma	48	211,169	15	53,604	203	1,168,207	350	1,432,986	4,025
South Dakota	0	0	0	0	1	8,000	1	8,000	
Tennessee	0	0	3	2,900	4	3,814	7	6,804	
Texas	163	752,053	51	289,202	1,047	4,793,784	1,261	5,835,120	4,627
West Virginia	1	2,160	3	7,525	14	72,708	18	82,303	
Wyoming	5	26,013	0	0	16	65,173	21	91,186	
Totals	529	2,060,298	126	672,005	3,188	12,381,061	3,843	15,122,364	3,035

* Gas-and-distillate (condensate) wells, of which there were 37 completed in 1943, are included in this column.

† Averages have been recorded here only for states where more than 25 exploratory holes were drilled in 1943.

TABLE IV. COMPARATIVE STATISTICS FOR ALL STATES SHOWN IN FIGURE 2*

Year	Producers Drilled				Dry Holes Drilled				Total Number Exploratory Holes Drilled	Total Feet Drilled	Average Depth of Hole (Feet)	Number of Dry-Hole Feet Drilled for Each Producer Foot
	Holes		Footage		Holes		Footage					
	Number	Per Cent	Feet	Per Cent	Number	Per Cent	Feet	Per Cent				
1938	200	13.6	984,462	17.8	1,271	86.4	4,697,462	82.6	1,471	5,631,664	3,842	4.74
1939	191	12.6	1,070,366	14.9	1,213	87.4	4,501,660	85.2	1,274	5,281,014	4,345	5.00
1940	187	12.8	1,070,526	14.9†	1,270	87.2	5,251,233†	85.1†	1,466	6,170,770	4,200†	5.71†
1941	258	16.5	1,264,774	18.4	1,305	83.5	5,578,975	81.6	1,503	6,843,740	4,372	4.41
1942	231	16.3	1,280,480	19.6	1,186	83.7	5,295,556	80.4	1,417	6,585,036	4,647	4.11
1943	287	17.3	1,546,956	18.8	1,369	82.7	6,680,512	81.2	1,656	8,227,468	4,968	4.32

* In this table New Mexico data are from the southeastern part of the state only.

† See *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 25, p. 1938, where corrections are mentioned for these figures as they appeared in Table II, p. 100†, of the same volume.

TABLE V
BASIS FOR LOCATING EXPLORATORY HOLES DRILLED IN 1943

State	Geology		Geophysics*		Geology and Geophysics		Sundry Non-Technical		Unknown		Totals		Grand Total
	Prod.	Dry	Prod.	Dry	Prod.	Dry	Prod.	Dry	Prod.	Dry	Prod.	Dry	
Alabama		3		2		2		1		1		9	9
Arizona		1										1	1
Arkansas	2	22		24	2	14		1		4	5	65	70
California	39	132	8	24	8	11	1		1	14	57	194	251
Colorado	1	5						3		1	1	10	11
Florida				1	1			7				9	10
Georgia								2				3	3
Illinois	86	280		54	6	32		34			108	400	508
Indiana	2	33		2				6		33	6	74	80
Iowa								2				2	2
Kansas	40	159	12	59		9		5			57	379	436
Kentucky (W)	18	25	1	9	5	34		2			26	127	153
Louisiana	22	70	19	44	13	37		59	1		54	154	208
Michigan	32	235				1					32	236	268
Mississippi	1	19	1	15	3	11		3		3	5	51	56
Missouri		2						4		1		7	7
Montana	3	22						2		2	3	26	29
Nebraska				15		4							29
New Mexico	4	22	3	6		4		3		7	8	34	42
North Dakota						1		2				1	1
Ohio (NW)	1	1	2					1				2	5
Oklahoma	23	129	35	89		6		69			63	293	356
South Dakota		1										1	1
Tennessee	1											4	7
Texas	128	655		193	27	75		2		4	3	1,047	1,261
West Virginia	4	10		4				7	1		214	14	18
Wyoming	4	11		1	1	2		1		1	5	16	21
Totals	411	1,828	149†	545†	66‡	243‡	23	500	6	72	655	3,188	3,843

* Including geochemistry.

† Of these holes 145 producers (123 wildcats, 22 outposts) and 508 dry holes (473 wildcats, 34 outposts, 1 deeper-pool test) were located by seismograph.

‡ Of these holes, 64 producers (43 wildcats, 17 outposts, and 4 deeper-pool tests), and 230 dry holes (202 wildcats, 25 outposts, and 3 deeper-pool tests) were located by seismograph and geology.

such advice. In the southern states area (Fig. 2) 5.4 per cent of the exploratory holes, located without technical advice, were producers, whereas 18.6 per cent of the holes located on technical advice were producers.

Comparing last year's figures¹⁴ with figures for 1943, we note the following conspicuous changes.

1. There was a considerable increase in the exploratory effort in most parts of the country, but in Illinois, Indiana, and Nebraska there was a marked reduction both in the number of exploratory holes drilled and in the total depth of these holes.

2. There was a decrease from 5,013 feet to 4,239 feet in the average depth of the holes drilled in California. It is noteworthy that last year also California showed no increase in average depth of exploratory hole drilled.¹⁵

3. On the other hand, deeper drilling is proved by marked increases in the average depths of exploratory holes from 3,521 feet to 3,707 feet in Kansas; from 1,736 feet to 2,071 feet in Western Kentucky; from 6,809 feet to 7,018 feet in Louisiana; from 5,276 feet to 6,773 feet in Mississippi; from 3,154 feet to 3,619 feet in New Mexico; and from 4,309 feet to 4,627 feet in Texas.

As in the past 2 years we are again submitting herewith special tables relating to the following eleven states: Arkansas, California, Illinois, Indiana, Kansas, Louisiana, Michigan, Mississippi, New Mexico, Oklahoma, and Texas. In Table VI are shown statistics on exploratory holes (previously all listed as wildcats, and so called), and in Table VII are statistics on proved reserves in the area of these same eleven states.

In Table VII, under A, are recorded the proved reserves as of January 1 in each of the indicated years, and for the eleven-states area under discussion. Under B is shown, for each January 1, the net change in estimated proved reserves since the preceding January 1, allowing for production during that 12-month period. Under C are the new proved reserves which are directly attributable to wildcat discoveries made during the year. Under D are the revisions and additions of estimated proved reserves in fields already discovered in previous years, these revisions and additions having been made on the basis of new information obtained through development during the year indicated. Under E all the new reserves (C+D) are totalled for each year.

If, for each year, we divide the newly discovered proved reserves (C, Table VII) by the number of exploratory holes drilled in that year, or by the total exploratory footage drilled in that year, we shall have a measure of the degree of success of exploratory drilling in terms of newly discovered proved reserves (G and H, Table VII); and if we divide the total new proved reserves (discoveries plus revisions plus extensions: E, Table VII) by the number of exploratory holes drilled, or by the total exploratory footage drilled, we shall have a rough measure

¹⁴ F. H. Lahee, "Wildcat Drilling in 1942," *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 27, pp. 715-29.

¹⁵ *Ibid.*, p. 721.

TABLE VI
STATISTICS ON EXPLORATORY HOLES IN AREA OF ELEVEN STATES*

	Located on Technical Basis				Non-Technical Location				Unknown Basis for Location				Totals				Grand Totals		Total Footage		Number of Holes Drilled in Producing Exploratory Wells
	Producers		Dry Holes		Producers		Dry Holes		Producers		Dry Holes		Producers		Dry Holes		Producers	Dry			
	Num-ber	Per Cent	Num-ber	Per Cent	Num-ber	Per Cent	Num-ber	Per Cent	Num-ber	Per Cent	Num-ber	Per Cent	Num-ber	Per Cent							
1937	214	16.05	1,110	83.95	17	5.80	276	04.20	48	9.21	473	90.79	270	12.00	1,868	87.01	1,188,466	7,002,875	5.89		
1938	283	17.03	1,205	82.97	43	6.01	522	09.37	17	4.97	347	95.33	343	13.68	2,104	36.32	1,482,889	7,110,807	6.66		
1939	210	13.33	1,494	86.67	27	7.01	346	04.38	48	9.21	125	95.67	125	12.92	2,750	38.71	1,307,496	8,110,415	6.02		
1940	309	15.60	1,665	84.40	35	4.57	731	05.43	11	0	55	100.00	402	15.31	2,597	84.08	2,032,184	9,222,217	4.55		
1941	403	20.17	1,832	79.83	20	3.92	710	06.08	0	12.36	78	87.64	609	17.22	3,569	87.83	2,004,038	9,591,767	4.58		
1942	438	18.25	1,961	81.75	21	3.81	530	06.19	11	0.33	59	90.77	609	17.22	2,927	82.78	2,043,377	11,065,176	4.44		

* This area includes California, New Mexico, Texas, Oklahoma, Kansas, Arkansas, Louisiana, Mississippi, Illinois, Indiana, and Michigan.

TABLE VII
STATISTICS ON PROVED RESERVES IN AREA OF ELEVEN STATES*

	1937	1938	1939	1940	1941	1942	1943	1944
A. Proved reserves as of Jan. 1 of year indicated	12,241,885,000	14,664,035,000	16,630,452,000	17,723,393,000	18,236,542,000	18,816,785,000	19,260,415,000	19,070,764,000
B. Net change in proved reserves since Jan. 1 of previous yr.		+2,422,150,000	+1,906,417,000	+1,092,041,000	+503,149,000	+590,243,000	+443,630,000	-189,651,000
C. New proved reserves discovered during year indicated	896,692,000	805,793,000	337,989,000	280,882,000	423,551,000	254,801,000	271,038,000	
D. New reserves added through exploration during year indicated	2,739,254,000	2,313,356,000	1,955,507,000	1,595,816,000	1,496,610,000	1,496,536,000	963,207,000	
E. Total new proved reserves added (C+D)	3,635,946,000	3,118,649,000	2,293,496,000	1,786,698,000	1,920,161,000	1,751,337,000	1,234,255,000	
F. Production during year indicated	1,213,796,000	1,152,231,000	1,200,555,000	1,283,490,000	1,320,018,000	1,307,707,000	1,423,906,000	
G. Newly discovered reserves (C) per exploratory hole drilled in year indicated	417,647	321,217	133,857	97,834	137,115	83,843	76,652	
H. Newly discovered reserves (C) per exploratory hole drilled in year indicated	109.4	93.6	39.9	28.6	37.7	21.8	11.98	
I. New proved reserves (E) per exploratory hole drilled in year indicated	1,603,500	1,243,076	908,315	622,326	621,612	576,287	349,052	
J. New proved reserves (E) per foot of exploratory hole drilled in year indicated	443.88	362.52	271.36	182.07	170.75	149.79	86.38	

* This area includes Arkansas, California, Illinois, Indiana, Kansas, Louisiana, Michigan, Mississippi, New Mexico, Oklahoma, and Texas. All figures are in barrels. These figures on reserves are taken from the published annual reports of the American Petroleum Institute's Committee on Oil Reserves.

TABLE VIII
DISTRIBUTION OF EXPLORATORY WELLS OF 1943 BY CLASSES AND RESULTS OF DRILLING

	A All States Included in Table III		B Southern States Included in Table IV		C* Eleven States Included in Tables VI and VII		D* States Included in Table III Except the 11 States in Tables VI and VII		
	Number	Footage	Number	Footage	Number	Footage	Number	Footage	
Wildcats	Producers	302	1,357,809	137	744,728	281	1,203,400	21	64,400
	Gas	65	273,546	27	147,574	55	240,602	10	26,944
	Gas-distillate	29	273,959	29	273,959	29	273,959	0	0
Total	396	1,925,314	193	1,166,284	305	1,813,970	31	91,344	
Dry	2,618	10,514,401	1,209	5,954,078	2,376	9,852,775	242	661,626	
Outposts	Producers	173	648,098	46	251,000	164	625,640	9	23,340
	Gas	13	60,323	7	41,759	12	50,533	1	799
	Gas-distillate	5	34,118	5	34,118	5	34,118	0	0
Total	191	743,439	58	327,777	181	719,300	10	24,139	
Dry	490	1,770,045	132	683,282	472	1,719,998	18	50,047	
Deeper-pool tests	Producers	54	62,401	28	40,528	50	60,478	4	2,013
	Gas	11	25,093	5	8,234	10	25,303	1	600
	Gas-distillate	3	4,156	3	4,150	3	4,150	0	0
Total	68	92,550	36	52,918	63	89,937	5	2,613	
Dry	80	90,615	28	43,129	79	92,403	1	4,212	
Total producers	655	2,741,393	287	1,546,956	609	2,623,297	46	118,006	
Total dry holes	3,188	12,381,061	1,360	6,080,512	2,927	11,665,176	261	715,885	

* The horizontal totals of Columns C and D equal the items in Column A.

TABLE IX
EXPLORATORY DRILLING IN 1943 IN NEW YORK, PENNSYLVANIA, AND EASTERN OHIO

	New York			Pennsylvania			Eastern Ohio			Totals	
	No.	Footage		Deep	Shallow		No.	Footage		No.	Footage
Wildcats	Productive	0	0	0	10	27,127	8	29,000	18	56,127	
	Dry	18	73,606	7	41,959	31,628	19	83,728	56	231,011	
Total		18	73,606	7	41,959	58,755	27	112,728	74	287,138	
Outposts	Productive	1	2,720	2	12,433	36,877	19	71,971	33	123,041	
	Dry	5	17,575	3	21,752	43,802	25	85,413	47	168,602	
Total		6	20,295	5	34,185	80,679	44	157,384	80	402,543	
Deeper-pool tests	Productive	0	0	1	480	14,406	0	0	8	14,805	
	Dry	0	0	1	668	2,105	0	0	3	2,773	
Total		0	0	2	1,157	16,511	0	0	11	17,668	
Totals	Productive	1	2,720	3	12,433	78,350	27	100,971	59	194,063	
	Dry	23	91,271	11	64,379	77,595	44	169,141	106	402,386	
Grand total		24	93,991	14	77,301	155,045	71	270,112	165	597,349	

of the degree of success of the exploratory effort (I and J, Table VII). Under G and H the measure is short. Under I and J, the measure may be too large or too small. In any case, there is an unavoidable error in estimating *rate of discovery*, or degree of success in wildcatting, measured in terms of new reserves; but the figures obtainable by these methods, as here described, are a significant index. As shown graphically in Figure 3, they reveal a marked drop in the rate of discovery from 1937 to 1943, inclusive, and this in spite of a steadily increasing footage drilled in exploratory holes and an increasing number of exploratory holes drilled each year. However, worthy of note is the fact that an increase in proved reserves newly discovered in 1943 resulted from the marked increase in exploratory drilling during that year. The effects of extending the newly discovered areas of 1943 should be observed especially in 1944 and 1945.

Up to this point, in Part III of this paper, the statistics which we have presented are analogous to those published in our earlier articles. They relate to the several kinds of exploratory wells, all totalled together, and, although in this paper we have called these exploratory holes (or wells), in previous years we called them all wildcats. There are, of course, objections that may be raised to this system since it fails to discriminate between those holes that are drilled to search for new fields, on the one hand, and those which are drilled in fields already discovered, on the other hand. The fact is that whatever the classification of an exploratory test may be, if it is successful it will probably add materially to crude oil reserves or to natural gas reserves. Therefore, from this point of view all of these groups of exploratory holes merit consideration.

We are unable now separately to classify new-field wildcats and new-pool wildcats of 1943, but we can group these together and list the data for wildcats, outposts, and deeper-pool tests. This we have done for the major groups of states in Table VIII. Observe that 3,014 of the exploratory holes drilled in 1943 were wildcats, whereas 681 were outposts and 148 were deeper-pool tests. In other words 78.4 per cent of all the exploratory holes recorded in this paper for 1943 were of the wildcat class. How much variation there may be in this relation from year to year is impossible for us to say since we do not possess the data, but for convenience and probably without introducing too serious an error, we might assume that about 80 per cent would be satisfactory. If this is fair, we may estimate that the number of wildcats drilled in 1942, under the same definition as that adopted in the present paper, was somewhere near 80 per cent of 3,212 or about 2,570; which would mean an increase in exploratory drilling of the wildcat class from approximately 2,570 in 1942 to 3,014 in 1943.

Whether we take the full number of exploratory holes (3,843) drilled in 1943, or merely the wildcat group of 3,014, both figures are far below P.A.W.'s urgent request for 4,500 in 1943. There is no question that the exploratory effort must be still further intensified in 1944.

APPENDIX

Through the kind cooperation of Fenton H. Finn, data were received on exploratory drilling in New York, Pennsylvania, and eastern Ohio, but too late for inclusion in the main body of this paper. This is just as well since data on these states, having never been received before, have not been included in our earlier articles. For those persons who may be interested, we record these additional statistics in Table IX. We wish to point out that all but one of the productive (successful) exploratory wells in New York, Pennsylvania, and eastern Ohio, were gas wells. Only one, with a depth of 3,514 feet is reported to have produced oil, and this was completed as an oil-and-gas producer.

DEVELOPMENTS IN APPALACHIAN AREA IN 1943¹

APPALACHIAN GEOLOGICAL SOCIETY²

Charleston, West Virginia

ABSTRACT

NEW YORK. The expected increase in wildcat drilling in New York state proved true in wells drilled but was utterly disappointing in results obtained. In the Oriskany sand area (southwestern New York) 12 wildcat wells were completed during 1943 as against 4 in 1942, but no new gas was found. In the Medina gas area of western New York about 29 wells were drilled. Four of these were storage wells and of the remaining 25 only 8 were producers. In the oil-producing area of southwestern New York approximately 1,500 wells were drilled in secondary-recovery operations and approximately 25 dry wells were drilled to shallow depths in an effort to extend old or find new producing Devonian sands.

Shallow oil and Oriskany gas production figures are given.

The procedure of drilling exploratory wells, both shallow and deep, on a cooperative partnership basis, continued to expand, and more wildcatting is expected in 1944 as results continue to be disappointing and gas reserves are further depleted.

PENNSYLVANIA. The number of wells completed in the shallow gas territory of western Pennsylvania (Upper Devonian or higher) in 1943 was 15.8 per cent less than in 1942. Of the wells drilled for gas, 75 per cent were producers and 25 per cent were dry. The 579 new gas wells had a total initial open-flow capacity of 147,282,000 cubic feet per day. No new gas pools of significant size were discovered.

Oil development work and production also declined markedly in 1943. Production in the Bradford field dropped 11.9 per cent, but the production of the field still accounted for 53 per cent of the total Pennsylvania-grade oil production of the Appalachian province in 1943. Only 2,118 new wells were completed in the field in 1943 as compared with 3,113 in 1942. In the Kane-to-Butler area, in which some water-flooding operations and a considerable number of air-repressuring projects are under way, the number of new wells completed in 1943 was only 392 as compared with 479 in 1942. Oil production in Pennsylvania, outside the Bradford field, declined 7.3 per cent during 1943.

Deep drilling operations in Pennsylvania also were curtailed during 1943. One gas well was completed in the southern extension of the Summit pool in Fayette County at the close of the year. Three dry holes were completed in this part of the Summit pool in 1943. Two wells in the main part of the pool were deepened, but only one produced additional gas in a limestone, probably Upper Silurian in age. In the Oriskany sand territory of north-central Pennsylvania two small gas wells and two dry holes were completed. Five other deep tests, all dry, were completed in western Pennsylvania during 1943. One well in eastern Mercer County failed to encounter any sand at the Medina horizon and is being deepened to the Trenton.

OHIO. 1,018 tests were completed in Ohio during 1943, of which 170 were oil, 455 were gas, and 393 or 31 per cent were dry. Development was confined to the Clinton sand and those lying above. New producing areas were all small and adjacent to older fields. The average initial production of oil was 40 barrels and of gas 915 M.C.F. per well. Due to the price of \$1.31 per barrel for Corning-grade oil, production declined 90,000 barrels. The greatest oil activity was in the Pennsylvania-grade fields, from which oil sold for \$2.55 a barrel. Production of this grade was increased by 7,500 barrels. Three Clinton gas wells had initial open-flow capacities in excess of 12,000 M.C.F. The largest oil well had an initial production of 550 barrels from the Clinton sand. The deepest test was drilled near the Ohio River in Olive Township, Meigs County, and reached a total depth of 7,466 feet which was 582 feet in the Trenton limestone. Development in the state is given by counties in tabular form.

WEST VIRGINIA. In 1943, 489 gas wells, 54 oil wells, 15 combination oil and gas wells, and 132 dry holes were completed. At least three apparently worthwhile discoveries were made in the shallow sands. In the deep sands no discoveries were made, that is, from sands below the top of the "Cornifer-

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ous lime." Twenty-four Oriskany sand dry holes were completed: 12 edge dry holes around the Elk-Poca and Sandyville fields, and 12 wildcats. Total initial gas volume developed was in excess of 325 million cubic feet, and initial oil developed was in excess of 656 barrels.

KENTUCKY. Oil production in Kentucky during 1943 reached its highest peak since 1930, with a production of 7,010,776 barrels—75 per cent coming from western Kentucky. Several new producing areas were added to the fields in the western coal basin and some interest was shown during the year in testing the Devonian and Silurian formations south and east of the western Kentucky coal basin. In Rowan and southern Lewis counties, the Gulf Oil Company drilled 13 dry holes testing the "Corniferous" with several penetrating the Brassfield with no results. Menifee, Elliott, and Jackson counties were active during the year and increased activity is expected during 1944. 166 wells were drilled in the Big Sandy gas field during 1943 for gas.

TENNESSEE.—Approximately 9,000 barrels of crude oil were produced during 1943 in Tennessee, east of the Cincinnati arch. Thirteen wells were spudded during the year; three were drilling on December 31, 1943. Of the 10 completions, representing 10,488 feet of hole, 3 were gas wells, only one of which has been placed on line. The most active areas were in Scott and Morgan counties. Later in the year interest was focused on the northern Cumberland Plateau where some surface work was done. This area promises to be the most active in the state in 1944.

NEW YORK

In 1943 wildcat drilling increased markedly in the southwestern part of New York state that is devoted to Oriskany gas production. In 1942, 4 wildcats were completed and 2 were drilling; in 1943, 12 unsuccessful Oriskany exploratory wells were completed and 5 wildcats were either drilling or located at the end of the year. These tests have been well distributed over the Oriskany sand producing area (Fig. 1 and Table I).

Several extension wells and inside locations were drilled during the year with only three wells saved as commercial producers. One of these, in the City of Elmira, was completed in Hamilton shales, just above the Oriskany horizon, producing only 52,000 cubic feet per day. The other two were in the yet unproduced Groton Township field in Tompkins County, and both were small wells.

The original discovery well of the Woodhull field in Oriskany sand at 3,955 feet is drilling at 5,075 feet and will test the Medina sand. As this is the first Medina test in the southern tier of New York state to be drilled on a well pronounced Oriskany structure, it is being watched with much interest.

The Medina gas production area of the state, located around Buffalo, had about 30 wells drilled during the year. Four of these wells were drilled for storage purposes and of the remaining only about 8 were producers. In this immediate area, production from the Medina sand is so spotty that almost any new location is a wildcat, even though it be less than 2 miles away from production. The Medina drilling in 1943 was largely in the area of Ashford Township, Cattaraugus County; Pavilion Township, Genesee County; and Boston, Collins and Newstead townships, Erie County. K. R. Wilson was drilling a Medina test on his own farm at Arcade, southwestern Wyoming County, as the year ended.

In the oil-producing area of Allegany and Cattaraugus counties, adjoining the Pennsylvania line, approximately 1,500 wells were drilled to depths of 1,600 feet average, in the secondary recovery program of water flooding. In the Allegheny County field alone there were 1,245 completions in 1943 as compared with 1,262 in 1942. The New York side of the Bradford field had about 250 completions.

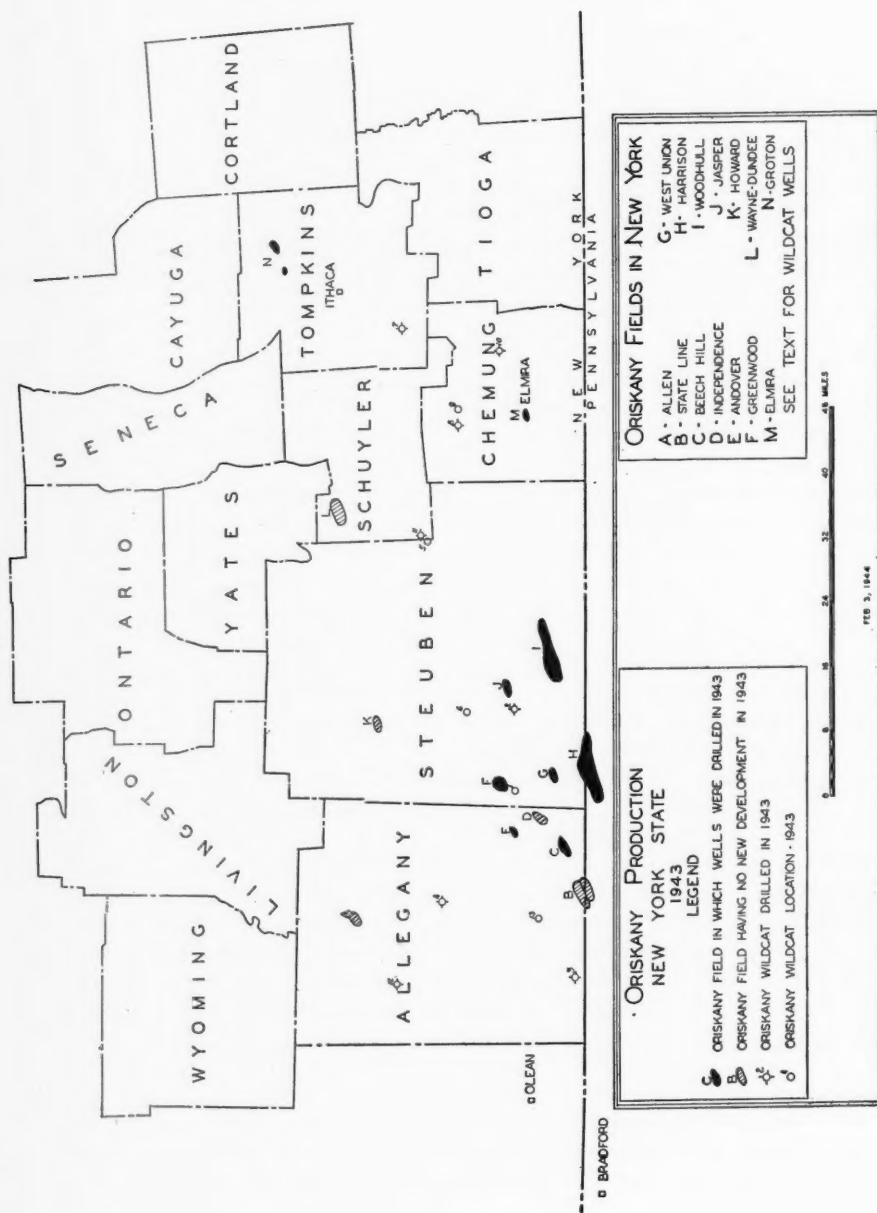


FIG. 1

TABLE I
DRILLING IN NEW YORK STATE IN 1943

County	Township	Company	Well	Field	Map No.	Class	Testing	Results	Completed
Steuben	West Union	BQ et al.	J. Lewis	West Union		Extension	Oriskany	SW Abd.	5/19
"	"	AG et al.	H. Joyce	"		"	"	18 MCF-SW Abd.	4/22
"	"	PY et al.	E. F. Dalley	"		"	"	5 M SW Abd.	10/27
"	Troupsburg	NYSN	R. Lozier	Harrison		"	"	Dry	11/22
"	Greenwood	HB et al.	H. Rogers	Greenwood	1	Wildcat	"	SW Abd.	1/14
"	"	AG et al.	H. W. Warner	"		Wildcat	"	"	3/9
"	"	BO et al.	S. Murray	"	1	Wildcat	"	"	Drilling, 2,100 ft. Building rig
"	Cameron	DYM	County 2	Jasper		Extension	"	SW Abd.	6/1
"	"	NYSN	G. Boyd 3	"	2	Wildcat	"	SW Abd.	11/2
"	Jasper	NP et al.	G. Murphy	Woodhull		Despensing	Medina	SW Abd.	8/5
"	Bradford	NYSN	Harrington	"	5	Wildcat	Oriskany	Rising up	Drilling, 5,075 ft.
"	Canisteo	AG et al.	Cratsley	"	6	Wildcat	"	Drilling, 355 ft.	1/7
Tompkins	Groton	BQ	A. C. Robertson	Groton		Extension	"	1,000 MCF-SW	2/28
"	"	BO	J. G. Gable	"		Extension	"	2,500 MCF-SW	2/28
"	"	BO	G. Smith East.	"		Extension	"	1 MCF-SW	5/20
"	Newfield	BO	F. Gillette	"	7	Wildcat	"	Dry	5/20
Chemung	Veteran	DYM	J. Earle	"	8	"	Tully	Dry	9/2
"	"	DYM	H. May	"	9	"	Oriskany	Dry	10/20
"	"	DYM	H. Beebe	"	9	"	"	4 MCF	Drilling, 710 ft.
"	"	DYM	H. Beebe 2	"	10	"	"	2 MCF	10/14
"	Erin	AG	M. Struzinsky	"		Inside	"	150 MCF-SW	12/8
"	Elmira	Bogert et al.	F. Riley Lot	Elmira		Wildcat	Hamilton sh.	22 MCF	12/8
"	Orange	NYSN	Tb. Buttrick	Elmira	11	Wildcat	Oriskany	Dry	7/31
Schuyler	Bolivar	AG et al.	Gadsby	"	3	Wildcat	"	Dry	5/6
Allegany	Andover	BQ et al.	H. Clark	Andover	4	Extension	"	100 MCF-SW	6/10
"	Angelica	AG et al.	G. Conrad	"	4	Wildcat	"	Dry	7/8
"	Belfast	AD	Barringer	"	12	Extension	"	No sand	10/14
"	Willing	Cunningham	C. Johnston	"		Extension	"	36 MCF-SW	11/18
"	Wellsville	AG et al.	W. Burrows	Beech Hill	13	Wildcat	"	16 MCF-SW	Drilling, 3,250 ft.
"	Alma	"	D. Gesing	"	13	Wildcat	"	"	11/18
"	"	"	K. Vesler	"		Wildcat	"	"	Building rig

BO—Belmont Quadrangle Drilling Corp.
AG—Allegany Gas Co.
PY—Penn York Natural Gas Co.
NYSN—New York State Natural Gas Corp.

HB—Hanley and Bird
AD—Appalachian Development Co.
DYM—Dusenberry, Yahn, Messer
NP—North Penn Gas Co.

There was a noticeable increase in test drilling outside the limits of actual oil production. Many of the independent operators and the larger companies having production in the Bradford-Allegany field moved outside known producing limits to prospect the many shallow lenticular sands known to have oil or gas showings in the Chemung formation (Devonian). Some of these wells were cored and tested, but no new secondary recovery or natural production was found. Practically all of these tests, about 25 in number, were drilled in Cattaraugus and Allegany counties.

Oil production from the Allegany County field in 1943 averaged 10,602 barrels per day as compared with 11,164 barrels per day in 1942. The Cattaraugus County side of the Bradford field produced about 3,200 barrels per day in 1943, and approximately 3,700 barrels per day in 1942.

Oriskany gas production from New York approximated 4,400,000 M.C.F. for 1943 as compared with almost 5,000,000 M.C.F. for 1942.

The 1942 trend to coöperative drilling of deep gas wells on a share-the-cost, share-the-production basis was continued and became more prevalent, spreading to the drilling of shallow oil and gas tests. As no new reserves were proved in 1943, natural gas resources have been further depleted. There was some leasing activity localized around wildcats both before and after reflection-seismograph work, but no major widespread leasing campaigns took place. All of the seismograph work was done by one crew.

PENNSYLVANIA³

INTRODUCTION

Drilling activity was curtailed appreciably in the shallow gas territory of western Pennsylvania (Upper Devonian or higher) during 1943 and even more so in the oil fields. The number of deep tests undertaken was also less than in 1942 and those completed did not open any new reserves of natural gas. Thus far, no commercial oil has been encountered in sands below the Upper Devonian in Pennsylvania.

SHALLOW-SAND DEVELOPMENTS

GAS

During 1943, 770 wells were completed in the shallow-sand gas territory of western Pennsylvania as compared with 914 in 1942, a decline of 15.8 per cent. Of the shallow wells drilled for gas, 75 per cent were producers and 25 per cent were dry. The 579 new gas wells had a total initial open-flow capacity of 147,282,000 cubic feet of gas per day.

Southwestern Pennsylvania.—Shallow-well completions in southwestern Pennsylvania are shown in Table IA. The 303 new gas wells had a total initial open-flow

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capacity of 97,050,000 cubic feet of gas per day. Fifty-two old gas wells were deepened with the results shown in Table II.

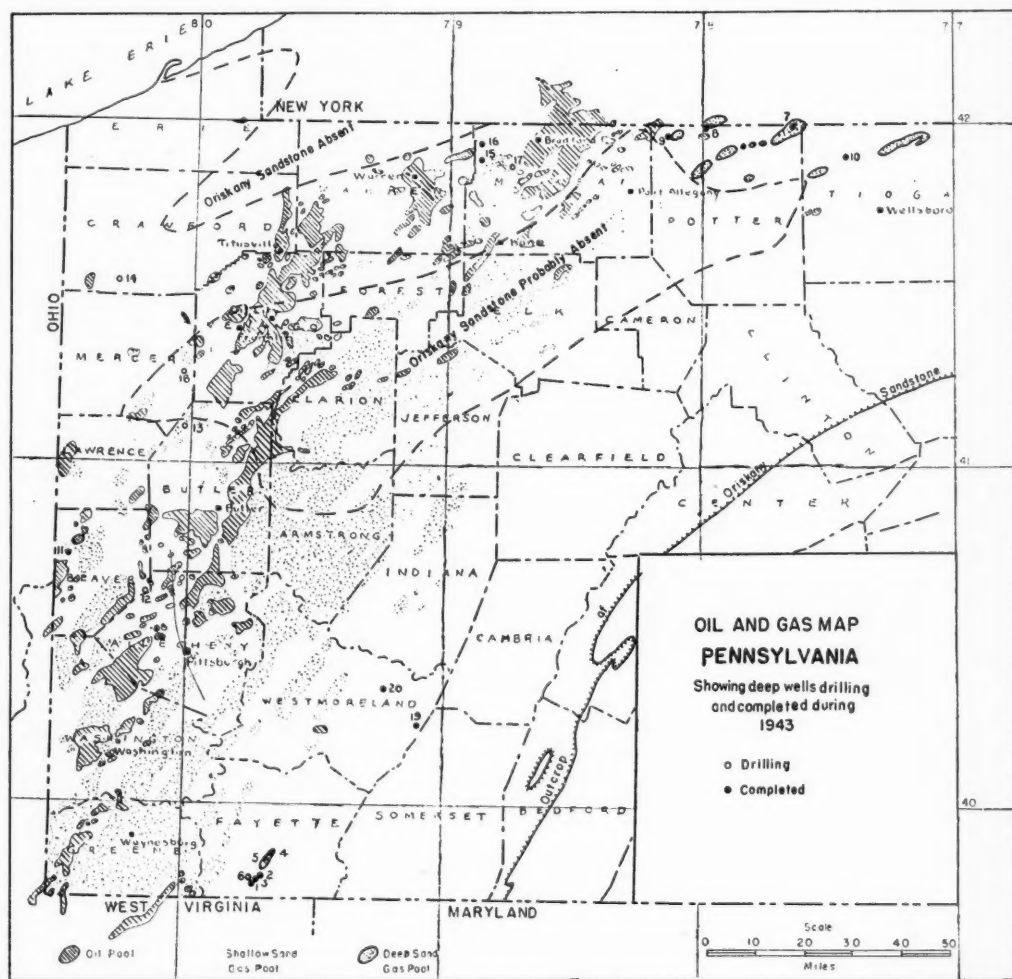


FIG. 2

A new Big Injun (Mississippian) sand gas pool was opened in Nicholson and Springhill townships in the southwestern part of Fayette County. The discovery well had an initial open-flow capacity of 900,000 cubic feet of gas per day and

TABLE IA
SHALLOW-WELL COMPLETIONS IN SOUTHWESTERN PENNSYLVANIA IN 1943

County	Completions		Gas			Oil			Dry	
	Number of Wells	Average Total Depth (Feet)	Number of Wells	Average Initial Open Flow M.C.F. per Day	Average Total Depth (Feet)	Number of Wells	Average Initial Production (Barrels per Day)	Average Total Depth (Feet)	Number of Wells	Average Total Depth (Feet)
Allegheny	25	2,668	17	472	2,683	2	3	1,757	6	2,932
Armstrong	111	2,917	101	132	2,922	0	0	0	10	2,860
Beaver	5	1,205	0	0	0	4	1	1,242	1	1,060
Butler	31	1,616	11	28	1,678	10**	1.0	1,586	10	1,570
Payette	54	2,383	31	359	2,178	1	40	4,210	22	2,589
Greene	70	2,887	44	485	2,909	2	17	1,099	24	2,954
Indiana	37	3,089	25	143	2,978	0	0	0	12	3,310
Lawrence	2	757	0	0	0	0	0	0	2	757
Washington	40	2,322	31*	487	2,375	2	2.25	1,104	7	2,438
Westmoreland	75	3,152	43	504	2,979	0	0	0	32	3,385
Total	450	2,717	303	320	2,742	21	5.1	1,569	126	2,847

* Includes 2 gas storage wells.

** Includes one intake well for pressure maintenance.

showed a reservoir pressure of 675 pounds per square inch. Two other wells have been completed, one with an initial open-flow capacity of 1,500,000 cubic feet per day and the other 1,100,000. The limits of the pool have not been determined. Three wells with initial open-flow capacities in excess of one million cubic feet per day were completed in the Big Injun sand field of eastern Greene County in Monongahela Township.

Other wells with initial open-flow capacities in excess of one million cubic feet of gas per day from Upper Devonian sands were located as follows: one each in Forward and Patton townships, Allegheny County; one each in Bethel and South Bend townships, Armstrong County; one in Washington Township,

TABLE II
GAS WELLS DEEPENED IN SHALLOW SANDS IN SOUTHWESTERN PENNSYLVANIA IN 1943

County	Successful		Dry
	Number of Wells	Additional Gas Average Initial Open Flow M.C.F. per day	
Allegheny	6	64	1
Armstrong	11	59	5
Beaver	0	0	0
Butler	1	10	1
Fayette	1	73	1
Greene	7	349	2
Indiana	1	9	0
Lawrence	0	0	0
Washington	4	95	6
Westmoreland	4	208	1
Total	35	136	17

Greene County; one each in Fallowfield and Somerset townships, Washington County; three in Bell and one in Hempfield townships, Westmoreland County. A considerable number of dry holes were drilled around the margins of the Armbrust gas pool in Hempfield Township, Westmoreland County, opened in the Fifth sand (Upper Devonian) in 1941. Two of the new wells completed in the pool still showed initial open-flow capacities of 998,000 and 1,500,000 cubic feet per day, respectively.

Northern and central districts.—A summary of activities in the shallow-gas territory of the northern and central districts during 1943 is given in Table III. The 276 new gas wells had a total initial open-flow capacity of 50,232,000 cubic

TABLE III
SHALLOW-WELL COMPLETIONS IN GAS FIELDS OF NORTHERN AND CENTRAL PENNSYLVANIA IN 1943

County	Completions		Gas			Dry	
	Number of Wells	Average Total Depth (Feet)	Number of Wells	Average Initial Open Flow M.C.F. per Day	Average Total Depth (Feet)	Number of Wells	Average Total Depth (Feet)
Clarion	69	2,253	57	108	2,187	12	2,566
Clearfield	9	3,095	5	2,283	2,959	4	3,265
Crawford	1	1,421	1	2	1,421	0	0
Elk	79	2,504	62	124	2,469	17	2,632
Forest	8	2,249	7	884	2,150	1	2,942
Jefferson	113	2,870	89	110	2,820	24	3,055
McKean	40	2,316	36	47	2,287	4	2,577
Venango	14	2,023	12	44	1,981	2	2,275
Warren	8	1,162	7	980	1,214	1	798
Total	341	2,508	276	182	2,444	65	2,777

feet of gas per day. The large average initial open-flow capacities of the wells in Clearfield, Forest, and Warren counties, shown in Table III, are due to the fact that the averages in these counties have been distorted by the completion of a few exceptionally large wells.

A small Venango Third Stray sand gas pool was opened in Cherry Grove Township in the southwestern corner of Warren County during the latter part of 1943. Four wells with average initial open-flow capacities of more than a million cubic feet per day each have been completed. About 130 acres have been proved. The sand ranges in depth from 740 to 780 feet. The reservoir pressure is only 85 pounds per square inch.

OIL

Drilling for oil fell off markedly during 1943. A total of 2,607 new wells, drilled mostly in connection with secondary-recovery operations, were completed as

compared with 3,727 in 1942, a decline in drilling activities of 29.8 per cent. In the Bradford field 2,118 new wells were drilled, about half of which were water intake wells, as compared with 3,113 in 1942, a decline of 32 per cent. Oil production in this field, about 86 per cent of whose area lies in Pennsylvania, dropped from 15,532,473 barrels in 1942 to 13,684,186 barrels in 1943, or 11.9 per cent. The field accounted for 53 per cent of the total Pennsylvania-grade crude-oil production of the Appalachian province in 1943. The daily average production in the central and southwestern districts of Pennsylvania declined from 10,038 barrels in 1942 to 9,304 barrels in 1943, or 7.3 per cent. The total production in 1943 of these two districts approximated 3,395,960 barrels, or 13.1 per cent of the total Pennsylvania-grade production.

A well in German Township, western Fayette County, is reported to have had an initial production of 40 barrels of oil per day from a sand encountered at a depth of 3,492-3,507 feet, probably representing the Speechley of the Upper Devonian. The location is outside the present oil-producing territory of western Pennsylvania.

The Forest Oil Corporation of Bradford began an attempt to recover oil from the Clintonville pool in southwestern Venango County by water flooding. This pool was discovered about 1890 and produces oil from the Venango Second sand. Previous water-flooding experiments in this sand have not been successful. Water was injected into about 20 specially drilled injection wells on a 5-spot pattern in the latter part of 1943. The method will thus be given an extensive test. Spacings range between 440 and 600 feet between like wells so that it will be many months before the results can be predicted.

During 1943, the attempt to exploit the First Venango sand in the old Franklin heavy-oil pool at Franklin, Venango County, by drilling horizontal wells from the foot of a shaft was continued. The shaft was sunk successfully through the oil sand with a circular chamber 27 feet in diameter and 60 feet high excavated in the sand and completely lined with concrete. The sand was notably lacking in gas and light hydrocarbons, but even less trouble was encountered from this source than had been anticipated. Conventional diamond drills were set up in the chamber on a platform. Two holes were drilled, diametrically opposite each other, to a distance of 2,285 feet and 2,245 feet, respectively. The holes were loaded with 80 per cent high-velocity gelatine from 500 feet to their ends and shot simultaneously by detonating with Prima cord. On February 1, 1944, they had not yet been cleaned out completely.

DEEP-SAND DEVELOPMENTS

Summit gas pool, Fayette County.—During 1943, new drilling was confined entirely to the southern extension of the pool, opened late in 1941. The new work is summarized in Table IV. Of the three wells completed, one was dry, one encountered salt water, and one a small flow of gas, not sufficient to make a commercial well. All three wells passed through faults before reaching the Onondaga.

TABLE IV
WELLS COMPLETED AND DRILLING IN SUMMIT POOL, FAYETTE COUNTY, PENNSYLVANIA IN 1943
(Depths are in feet)

Map No.	Township	Well	Company	Elevation (Feet above Sea-Level)	Tully	Top Onondaga Limestone	Top Chert	Oriskany	Total Depth	Date Completed	Results
1	Georges	Wm. R. Barton 3	Greenshoro Gas Co.	2,451	6,597-6,599 6,781-7,021	7,607	7,631	7,798-	7,810	1-19-43	Salt water at 7,810
2	Wharton	Indian Creek Coal and Coke Company 2	New Penn Dev. Corp. and Wm. E. Snee	2,674	7,555-7,600	8,303	8,335	8,590-8,618	8,685	7-20-43	Dry in Onondaga and Oriskany. Abandoned
3	Georges	George Walters et al. 1	Peoples Natural Gas Co.	2,583	6,912-7,052	7,630	7,660		8,115	10-7-43	Tested 650 M.C.F. at 7,794 but blew down to 50 M.C.F. at completion. Abandoned

WELLS DEEPENED											
4	S. Union	Leo F. Heyn 1	New Penn Dev. Corp. and Wm. E. Snee	2,316	6,021-6,100	6,572	6,593	6,777-6,848	7,508		Deepened from 6,843 to 7,508. 115 M.C.F. additional gas at 7,181-7,200. 525 M.C.F. additional gas at 7,267-7,347
5	S. Union	Leo F. Heyn 3	New Penn Dev. Corp. and Wm. E. Snee	2,314	5,845-5,015	6,303	6,394	6,566-6,671	7,400		Deepened from 6,792 to 7,400. No additional gas

WELLS DRILLING											
6	Georges	Wm. R. Barton 4	Greenshoro Gas Co.	2,370	6,425-6,595	6,085	7,018	7,340-			1,250 M.C.F.—I.O.F. from Onondaga chert. Drilling deeper at end of year

TABLE V
ORISKANY SAND WELLS COMPLETED IN NORTH-CENTRAL PENNSYLVANIA IN 1943
(Depths are in feet)
POTTER COUNTY

Map No.	Township	Well	Company	Elevation (Feet above Sea-Level)	Tully	Onondaga	Oriskany	Total Depth	Date Completed	Results
7	Harrison	S. W. Berry 2	Allegheny Gas Co.	2,159	4,386-4,427	5,057-5,089	5,089-	5,112	1- 9-43	Gas 5,094-5,112. 200 M.C.F.—I.O.F. after shot
8	Oswayo	Margaret Coyle 1	D. Y. M. Corp.	2,113	4,301-4,355	4,868-4,913	4,913-	4,923	4-22-43	180 M.C.F.—I.O.F. gas from Oriskany
9	Sharon	Mary White Estate 1	Allegheny Gas Co. and Hanley & Bird	2,026	4,339-4,410	4,834-4,911	4,911-4,918	4,952	5-14-43	Dry in Oriskany

TIOGA COUNTY										
10	Deerfield	Floyd Hunter 1	Allegheny Gas Co. and Hanley & Bird	1,750	4,202-4,257	5,027-5,033	5,033-5,046	5,102	7-12-43	Dry in Oriskany. Oriskany horizon calcareous

One other well in this part of the pool, which was still drilling at the end of the year, gave promise of becoming a commercial producer. Whether the southern extension connects with the main Summit pool has not been established thus far. There is a gap of 2.6 miles between the southernmost producer in the main pool and the northernmost of the two producing wells in the southern extension.

In the northern or main part of the pool, opened in 1936, two wells, namely, Heyn No. 1, the discovery well, and Heyn No. 3, were deepened. In Heyn No. 1 an additional flow of gas was encountered in a limestone that, it is believed, occurs in the top part of the Upper Silurian series. Heyn No. 3 well entered the drag zone of a reverse fault below the Oriskany and has not yet reached the top of the Silurian system. A vertical separation of 850 feet, measured on the base of the Oriskany, has occurred in the well.

Oriskany gas fields of north-central Pennsylvania.—Only four wells were completed in the Oriskany gas fields of north-central Pennsylvania during 1943, as shown in Table V. Of the three wells in Potter County, two were small gas wells—one in the north part of the Harrison pool and the other at the southwest edge of the State Line pool. The third well, a short distance west of the Sharon pool, was dry in the Oriskany. The well in Tioga County was located on the north flank of the Sabinsville anticline between the Tioga and Sabinsville pools. The well was dry in the Oriskany sandstone which was found to be very calcareous.

Other deep tests.—The results of deep drilling during 1943 in western Pennsylvania outside the producing areas are summarized in Table VI. Of the five wells completed, none was successful. The two wells completed in Corydon Township, McKean County, represent unsuccessful attempts to locate a stratigraphic trap-type gas pool in the Oriskany sandstone which feathers out updip northwest. The Davidson well, in the east part of Mercer County, encountered no sand whatever in the interval where the Medina sandstone was expected and very little red shale in the interval normally occupied by the Queenston red shale. This is the first well in western Pennsylvania in which the Medina sandstone has been absent. Wells 17 miles west and 12 miles south, respectively, of the Davidson well encountered normal Medina sections. A satisfactory explanation of this exceptional condition at the site of the Davidson well remains to be worked out.

The two deep wells completed in Westmoreland County during 1943 illustrate the complexly faulted conditions encountered in depth along the more prominent foreland folds that are superimposed upon the southeast limb of the Allegheny synclinorium in western Pennsylvania. The wells were located on the basis of careful surface mapping. Both encountered faults whose presence had not been revealed by the surface work. The Beck well, located on a prominent dome along the Laurel Hill anticline, is 160 feet higher structurally at the surface than another well on the same dome $2\frac{1}{2}$ miles northeast, and on the top of the Onondaga formation it is 1,000 feet lower. The Giffin well, located on a similar dome along the Chestnut Ridge anticline, passed through the Tully limestone twice with a vertical separation of 755 feet.

TABLE VI
DEEP TESTS COMPLETED AND DRILLING IN WESTERN PENNSYLVANIA IN 1943
(Depths are in feet)

Map No.	County	Township	Well	Company	Elevation Feet above Sea Level	Tully	Onondaga	Oriskany	Lockport	Medina	Total Depth	Date Completed	Results
11	Beaver	Ohio	Cunningham-Zladovich 1	South Penn Oil Co.	1,155		4,650- 4,846	4,846-			4,862	8-14-43	Slight showing of gas in Oriskany. Salt water rose 4-100 feet from Oriskany
12	Beaver	Harmony	Spang Chalcant 1	National Supply Co.	767								Drilling
13	Butler	Mercer	Jessie C. Hockenberry 1	The Manuf. Light and Heat Co.	1,306		4,710- 4,828	4,828- 4,841	5,035- 6,185	6,452- 6,636			Dry at 6,680. Drilling deeper
14	Crawford	East Fallowfield	Ellen Calvin 1	The Sylvania Corp.	1,342	3,583- 3,127	3,242- 3,431	3,431- 3,448	4,190-				Hole full of S.W. in Oriskany. Drilling
15	McKean	Corydon	Warrant 3707 No. 1	Appalachian Dev. Corp.	1,358	3,452- 3,475	3,785- 3,835	3,835-			3,845	5-1-43	14 bailers S.W. per hour from Oriskany. Abandoned
16	McKean	Corydon	Warrant 3704 No. 1	Appalachian Dev. Corp.	2,090	4,010- 4,033	4,320- 4,397	4,397-			4,406		30 M.C.F.-1.0 F gas and S.W. in Oriskany at 4,401. Abandoned
17	McKean	Lafayette	Warrant 3416 No. 4	South Penn Oil Co.	2,137	4,477- 4,505	4,856- 4,874	4,874- 4,897					1 bailer S.W. per hour from Oriskany. Drilling
18	Mercer	Worth	Maude Davidson 1	United Natural Gas Co.	1,430		4,050- 4,171	4,171- No sand	5,102- 5,456	No sand			Drilling at 7,110. 2-11-44
19	Westmoreland	Ligonier	John Beck 1	New Penn Dev. Corp. and Wm. E. Shree	2,784		8,645- 8,847	8,847- 8,950			9,024	9-30-43	Dry in Onondaga and Oriskany. Abandoned
20	Westmoreland	Derry	Camilla F. Giffin 1	Peoples Natural Gas Co.	2,352	7,235- 7,285 7,990- 8,038					8,050	1-4-44	Abandoned above Onondaga

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Bulletin M 25, Pennsylvania Geological Survey, Fourth Series, on the "Oil and Gas Geology of the Oil City Quadrangle, Pennsylvania," prepared by Parke A. Dickey, R. E. Sherrill, and L. S. Matteson, was the outstanding publication relating to the geology of the oil and gas fields of western Pennsylvania to appear in 1943. This report of 200 pages covers not only the Oil City Quadrangle but discusses at length the geological factors that have had a bearing on the occurrence of oil and gas over the entire Venango district.

OHIO

The price schedule during the year caused a slight decrease in the number of oil wells completed in Ohio. One hundred seventy oil wells were drilled and, although production of Corning grade declined by approximately 90,000 barrels, that of Pennsylvania grade increased approximately 7,500 barrels. Initial production of oil wells completed during the year totaled 6,610 barrels.

No large gas fields were discovered in the state. However, 29 small producing areas were opened, all of which were adjacent to older production. The total initial open-flow capacity of new gas developed was 415,273 M.C.F.

Development was confined to eastern Ohio in the Clinton and shallow fields. There was very little drilling and no new production of consequence in the Trenton area.

Fifteen Oriskany gas wells, with an average open-flow capacity of 1,650 M. C. F., and two dry holes were drilled in a northeast extension of the Cambridge gas field in Wheeling and Liberty townships, Guernsey County.

The largest Clinton gas well was the Stetzer No. 1 in Sec. 2, Wayne Township, Muskingum County, with an open flow of 14,000 M. C. F. and a closed pressure of 1,160 pounds, which was completed at a depth of 4,031 feet. The N. W. Larson No. 1 in Lot 9, Pennfield Township, Lorain County, and the C. L. Bittner No. 2 in Lot 1, Wellington Township, Lorain County, had open-flow capacities of 13,500 M. C. F. and 12,470 M. C. F., respectively. Both produce from the Clinton sand at approximately 2,400 feet.

The largest oil well completed was the Johnson No. 1 in the 4th quarter of Falls Township, Muskingum County, with an initial production of 550 barrels of Pennsylvania-grade oil. Two additional tests on the same farm were dry and a north offset was rated at 30 barrels.

Thirty-three oil wells, 3 gas wells, and 11 dry holes were completed in the Pennsylvania-grade oil field producing from the Clinton sand in Clayton Township, Perry County. The largest well completed in this field during the year was the Adrian No. 1, rated at 270 barrels. One hundred sixty-five wells are now producing in this pool; more than 4,000 acres are proved.

The deepest dry hole was the wildcat, Longworth No. 1, drilled by the Sinclair-Prairie Oil Company in Sec. 22, Olive Township, Meigs County. This test penetrated the Berea, Oriskany, Newburg, Clinton, and reached the top of the

Trenton at 6,884 feet. It was continued to the depth of 7,466 feet, which was 582 feet in the Trenton limestone.

Development in Ohio during 1943 is given by counties and sands in the following tables. All sands above the Berea (basal Mississippian) are grouped as shallow. Certain wells which made both oil and gas were classed as oil wells in the final summary.

WELLS COMPLETED IN OHIO IN 1943
Summary by Counties and Sands

County	Sand	Gas Wells	Initial Open Flow (M.C.F.)	Oil Wells	Initial Production (Barrels)	Dry	Total
Ashland	Berea	1	136	5	70	3	9
	Clinton	21	9,821	0	0	11	32
		22	10,056	5	70	14	41
Athens	Shallow	13	7,837	7	45	14	34
	Berea	12	4,454	3	45	19	34
	Clinton	2	807	0	0	3	5
		27	13,098	10	90	36	73
Belmont	Shallow	0	0	0	0	1	1
	Berea	0	0	0	0	1	1
		0	0	0	0	2	2
Carroll	Berea	0	0	4	7	2	6
Columbiana	Berea	1	20	1	3	7	9
Coshocton	Clinton	8	3,095	8	271	11	27
Cuyahoga	Newburg	1	1,500	0	0	0	1
	Clinton	0	0	1	8	2	3
		1	1,500	1	8	2	4
Fairfield	Clinton	5	763	1	12	4	10
Fulton	Traverse	9	1,240	0	0	1	10
Gallia	Shallow	1	489	0	0	2	3
	Berea	0	0	0	0	3	3
	Clinton	4	8,096	0	0	0	4
		5	8,585	0	0	5	10
Guernsey	Shallow	0	0	1	8	2	3
	Berea	5	142	1	3	2	8
	Oriskany	15	23,219	0	0	2	17
	Clinton	0	0	0	0	2	2
		20	23,361	2	11	8	30
Hancock	Trenton	0	0	0	0	1	1
Harrison	Shallow	0	0	0	0	1	1
	Berea	0	0	3	3	0	3
		0	0	3	3	1	4
Henry	Trenton	0	0	2	4	2	4

WELLS COMPLETED IN OHIO IN 1943—Continued
Summary by Counties and Sands

County	Sand	Gas Wells	Initial Open Flow (M.C.F.)	Oil Wells	Initial Production (Barrels)	Cry	Total
Hocking	Shallow	1	50	0	0	0	1
	Berea	0	0	0	0	1	1
	Ohio shale	1	60	0	0	0	1
	Clinton	6	9,097	2	58	3	11
		8	9,207	2	58	4	14
Holmes	Berea	4	208	0	0	0	4
	Newburg	1	157	0	0	0	1
	Clinton	21	36,066	1	25	17	39
		26	36,431	1	25	17	44
Jackson	Clinton	0	0	0	0	1	1
Jefferson	Shallow	0	0	1	2	0	1
	Berea	0	0	0	0	5	5
		0	0	1	2	5	6
Knox	Berea	0	0	0	0	2	2
	Clinton	5	2,182	5	142	11	21
		5	2,182	5	142	13	23
Lake	Clinton	0	0	0	0	1	1
Lawrence	Ohio shale	1	125	0	0	0	1
	Clinton	3	2,812	0	0	5	8
		4	2,937	0	0	5	9
Licking	Berea	0	0	2	32	0	2
	Clinton	5	585	0	0	4	9
		5	585	2	32	4	11
Lorain	Clinton	29	86,940	0	0	24	53
Mahoning	Berea	0	0	0	0	1	1
	Clinton	0	0	0	0	1	1
		0	0	0	0	2	2
Medina	Berea	0	0	1	60	0	1
	Clinton	38	35,488	2	24	14	54
		38	35,488	3	84	14	55
Meigs	Shallow	8	1,526	0	0	7	15
	Berea	17	3,032	4	52	3	24
	Ohio shale	1	65	0	0	0	1
	Trenton	0	0	0	0	1	1
		26	4,623	4	52	11	41
Mercer	Trenton	0	0	2	32	0	2
	Sub-Trenton	0	0	0	0	1	1
		0	0	2	32	1	3
Monroe	Shallow	2	80	8	392	8	18
	Berea	9	929	1	10	2	12
		11	1,009	9	402	10	30

WELLS COMPLETED IN OHIO IN 1943—Continued
Summary by Counties and Sands

County	Sand	Gas Wells	Initial Open Flow (M.C.F.)	Oil Wells	Initial Production (Barrels)	Dry	Total
Morgan	Shallow	13	6,751	4	7	8	25
	Berea	25	2,256	0	0	4	29
	Clinton	15	24,217	1	105	13	29
		53	33,224	5	112	25	83
Muskingum	Oriskany	0	0	1	40	0	1
	Clinton	35	51,983	13	1,411	26	74
		35	51,983	14	1,451	26	75
Noble	Shallow	3	7,034	5	27	10	18
	Berea	16	5,244	0	0	15	31
	Oriskany	0	0	0	0	1	1
		19	12,278	5	27	26	50
Perry	Berea	8	1,990	3	7	6	17
	Newburg	1	400	0	0	0	1
	Clinton	13	9,043	52	3,627	36	101
		22	11,433	55	3,634	42	119
Preble	Trenton	0	0	0	0	1	1
Richland	Clinton	7	9,155	0	0	3	10
Stark	Clinton	25	22,424	0	0	7	32
Summit	Oriskany	2	437	0	0	3	5
	Newburg	1	586	0	0	1	2
	Clinton	10	3,785	0	0	5	15
		13	4,808	0	0	9	22
Tuscarawas	Clinton	11	14,192	0	0	8	19
Vinton	Shallow	1	31	0	0	0	1
Washington	Shallow	15	3,065	6	16	19	40
	Berea	5	163	0	0	4	9
		20	3,228	6	16	23	49
Wayne	Berea	2	513	0	0	2	4
	Clinton	13	10,983	0	0	11	24
		15	11,496	0	0	13	28
Wood	Trenton	0	0	3	62	2	5
Total "pays"		471	415,273	154	6,610	393	1,018
Less combination oil and gas wells counted twice							16
Holes actually drilled							1,002

WEST VIRGINIA

The year 1943 passed in West Virginia with only minor shallow sand discovery and none in the deeper sands, that is, in the Oriskany and below.

WELLS COMPLETED IN OHIO IN 1943
Summary by Sands

<i>Sand</i>	<i>Gas Wells</i>	<i>Initial Open Flow (M.C.F.)</i>	<i>Oil Wells</i>	<i>Initial Production (Barrels)</i>	<i>Dry</i>	<i>Total</i>
Shallow	57	26,863	32	497	72	161
Berea	105	19,087	28	292	82	215
Ohio shale	3	250	0	0	0	3
Traverse	9	1,240	0	0	1	10
Oriskany	17	23,656	1	40	6	24
Newburg	4	2,643	0	0	1	5
Clinton	276	341,534	86	5,683	223	585
Trenton	0	0	7	98	7	14
Sub-Trenton	0	0	0	0	1	1
Total "pays"	471	415,273	154	6,610	393	1,018
Less combination oil and gas wells counted twice						16
Holes actually drilled						1,002

Total wells drilled, as reported by the Department of Mines, along with their various classifications, are as follows. These figures are only approximate due to tardy reports on wells completed during the final weeks of the year.

Drilling permits issued	878
Gas wells completed	489
Oil wells	54
Combination oil and gas wells	15
Dry holes	132

Completion data in 97 instances did not give the volume of oil and gas developed, but total reported new gas volume amounted to 325 million cubic feet, and new oil volume amounted to 656 barrels daily.

Abandonments for 1943 were 290 gas wells and 254 oil wells.

Oriskany sand developments for the year, insofar as gas production is concerned, are shown in the following table, the Elk-Poca and Sandyville areas being the south and north parts of one field.

	<i>Gas Wells</i>	<i>Initial Open Flow M.Cu.Ft.</i>
Elk-Poca	55	167,300
Sandyville	22	55,498
Campbells Creek	1	516
Totals	78	223,314

At year's end, only 11 wells were drilling in the Oriskany sand fields, this comparing with 55 at the end of 1942, and indicating the end of active drilling operations is definitely in sight. Of these operations, one is in the Campbells Creek area, 5 are in the Elk-Poca area, and 5 in the Sandyville area.

It may be of interest to note that, in all, 911 Oriskany sand gas wells have been drilled with total initial open-flow volume of 4,942,000,000 cubic feet.

Twenty-four Oriskany sand dry holes were completed during the year, spread over 12 counties as follows: Kanawha 3, Jackson 6, Wayne 2, Boone 3, Putnam 2, Wood 2, and one each in Gilmer, Pleasants, Wirt, Wyoming, McDowell, and Raleigh. Of these, 12 were wholly wildcat, the balance being edge dry holes. In the shallow sands, that is from the Berea sand upward, there were many edge wells and semi-wildcats drilled, but in three instances new discoveries were made, which may be of some consequence.

The Delsie Mellinger Berea sand well near Ogden in Wood County, with initial oil volume of about 25 barrels, seems to have opened a new Berea lens in a very old area of drilling operations. Gas volumes of more than 2,000 M. cubic feet and rock pressure of 700 pounds have been developed since discovery.

In Wyoming County, two Berea sand gas wells were completed during the latter part of the year. One gauged 440 M. and the other 2,475 M. cubic feet, both after shot. They are 5 miles apart and the first producers in the general area from this sand, but past drilling in the vicinity has indicated very erratic occurrence of porosity, which seems to be the controlling factor as there is little evidence of structural influence.

In Wood County, an area of possible Big Injun sand gas production is indicated by the drilling of two wells in an old Cow Run field. The first of these may be classed as a pool wildcat, both volume and rock pressure indicating an undepleted sand area.

As at the end of 1943, an interesting test is the drilling well in Tucker County, which at the depth of 7,979 feet is reported being changed over to rotary. Apparently, the top of the "Corniferous lime" has not yet been reached, but some 125 M. cubic feet of gas has been picked up in the shale above.

In Wood County, two Oriskany sand tests were drilling, the deepest at the end of the year being at about 1,800 feet. Aside from these three, no deep tests were drilling.

As concerns the matter of exploratory drilling below the Oriskany level, the Newburg horizon was tested five times, these wells being included in the total of Oriskany sand dry holes. Three of the tests are located in the northeast corner of Boone County, southwest of the Campbells Creek field. Two of these were small gas wells in the Newburg, while the third was dry. The other two are located in northern Wayne County and both were dry at the Newburg level. However, one is a gas well in the Big Six sand but the other was dry in that formation also.

In two instances, the Clinton horizon was drilled through. One of these tests is located in the northeast part of Boone County where the sand was found with no gas. The other test is located in northwestern Wayne County, the formation appearing only as a few feet of shell, with no indication of gas. Both of these tests are included in the total of Oriskany sand dry holes.

At the end of the year, one well in Jackson County, abandoned in the Oriskany sand as a gas well, was being drilled to the Clinton horizon, there being no particular geological reason. It will, however, test a possible deeper producing forma-

tion in an area of closely held leases and one in which there will shortly be Oriskany sand abandonments.

KENTUCKY

During 1943, Kentucky produced more oil than at any time since 1930, the total being 7,010,776 barrels as compared with 4,169,163 barrels in 1942.

Of this total, 5,260,763 barrels were produced from western Kentucky, of which 692,359 barrels were from 18 new pools discovered during the year, and 3,260,765 barrels from the Smith Mills pool discovered in 1942.

This demonstrates effectively the desire of oil operators in Kentucky to cooperate in meeting the increased demands made by the war, regardless of low price of crude oil and high price of labor and materials.

EIGHTEEN NEW POOLS DISCOVERED IN WESTERN KENTUCKY, 1943

County	Pool	Location	Discovery Date	No. Wells	Barrels Daily Aver.	Total Barrels for 1943
Daviess	Panther	11-N-27	6-2-43	4	206	18,923
	Cairo	17-O-23	6-30-43	1	25	3,075
Henderson	Geneva	16-Q-22	12-20-43	4	298	9,240
	Greenbriar	24-O-24	7-14-43	1	28	2,624
	Poole	2, 3, 8, 9, N-23	6-2-43	14	334	75,520
		14-N-24				
	Robard	21, 22-O-23	2-17-43	9	200	70,440
	Zion	25-P-25	2-17-43	1	5	1,183
McLean	N. Livermore	24-M-29	5-1-43	1	31	3,021
Ohio	Barnett Creek	12-M-31	10-27-43	1	8	241
Union	Chapman	3-O-20	12-20-43	1	17	524
	Hitesville	4-O-21	7-7-43	9	264	48,498
		24-P-21				
	Morganfield	12, 13-O-19	5-10-43	6	247	53,004
	Raleigh	13-O-18	10-27-43	2	55	5,373
	St. Vincent	9, 12-O-20	6-30-43	17	1,669	356,750
	Uteley	16-P-21	2-24-43	2	59	18,841
Webster	Clay	23-M-21	9-29-43	2	18	1,671
	East Poole	10-N-23	7-14-43	1	13	2,375
	Pratt	14-N-24	7-21-43	4	157	24,056

Several new producing areas were added to the list of fields in the Western Kentucky coal basin, in Daviess, Henderson, McLean, Ohio, Union, and Webster counties. The Smith Mills pool was enlarged and oil was found in the McClosky (Ste. Genevieve) in addition to the Cypress sandstone from which much of the earlier oil had been produced.

There was some interest during the year in testing the Devonian and Silurian formations in the area south and east of the Western Kentucky coal basin. In the fall of 1943 a 15-to 20-barrel well was drilled in Allen County and two more wells are now being drilled. The production was obtained from within a few feet of the base of the Chattanooga black shale, probably in the upper Silurian.

EASTERN KENTUCKY

In the summer of 1943 the Gulf Oil Company, with approximately 70,000 acres under lease in Rowan and southern Lewis counties, drilled 13 wells for the

purpose of testing the so-called "Corniferous" (Niagaran dolomites and dolomitic sandstones) in a position on the Cincinnati arch similar to that occupied by the Big Sinking pool on the south. No oil was found other than showings in most of the wells. Several were drilled through the Brassfield to see whether or not this formation, which is commonly saturated at the outcrop, might produce down-dip. The percentage of sand to dolomite and the thickness of the formation varied very little in the entire area tested.

The redevelopment of the old Mariba-Denniston and Ragland oil fields of Menifee County, which was begun in 1942, became important in August, 1943, when production was increased from 75 barrels to 1,500 barrels per month. This is heavy black oil only good for diesel and fuel oils. War conditions have made it profitable for the refineries to handle such oil. There will probably be an increase in production from this area during 1944 as the limits of the field are not yet known.

When the deep Knox test was drilled in Elliott County, on the Burkes dome, a zone capable of producing $2\frac{1}{2}$ barrels of oil was encountered in the Weir sand. The drillers acquired this well and drilled another to the Weir about 100 feet from it. They shot this well, which is ordinarily the key to Weir production, and it is now producing naturally 25-30 barrels per day. Four other wells and two dry holes have been drilled since. The four producing wells are now making 8-15 barrels per day. During the next year there will undoubtedly be an extensive development program because in the last 5 or 6 months more than 80 per cent of the leases available has been acquired by minor and major operators. This area is on the same Paint Creek uplift on which are located the Magoffin and Johnson counties fields which have produced oil since 1918. It has yet to be proved whether the fault on the north, which has 62 feet of displacement, will have any effect upon production. Many operators think production will be encountered on the north side of the fault as well as on the downthrown side. However, no wells have yet been drilled north of the fault.

In Jackson County, the area down-dip from the gas field is being tested for oil and is being watched with great interest. At the end of 1943, five wells had been drilled, three of them oil wells capable of producing 50-75 barrels per day. This oil is produced from the thinning Niagaran dolomites ("Corniferous"). The area is being further developed and it is probable that Jackson County and Elliott County will be outstanding for new activity in eastern Kentucky next year.

In the Big Sandy gas field of Floyd, Magoffin, Pike, Knott, and Martin counties, 166 wells were drilled for gas during 1943, making a total for these five counties of 3,196 wells. These produce from the following formations.

<i>Per Cent</i>	<i>Formation</i>
6.8	Salt sands—Pennsylvanian
11.2	Maxon sand—Mauch Chunk
6.7	"Big Lime"—Mississippian
61.9	Black shale—Devonian
3.0	Big Injun, Berea and "Big 6"
10.4	are dry holes

In the following counties, gas wells were drilled as listed.

<i>County</i>	<i>Wells</i>
Johnson	8
Clay	4
Knox	2
Wolfe	8
Jackson	7

At present there are 97 strings of tools drilling for gas and it is estimated that 200 gas wells will possibly be drilled during 1944.

TENNESSEE EAST OF CINCINNATI ARCH¹

Approximately 8,200 barrels of oil was produced east of the Cincinnati arch in Tennessee during 1943. This is a slight decrease from the preceding year and the lowest since 1934. Approximately 7,200 barrels came from the Mississippian limestone pools in Scott and Morgan counties. Six wells in Clay, Fentress, and Pickett counties, pumped intermittently, produced about 1,000 barrels.

Natural gas was marketed from wells in Morgan and Fentress counties for consumption in the Sunbright and Jamestown areas, respectively. The Morgan County production was about 10,000,000 cubic feet and approximately 8,000,000 cubic feet was produced from the Jamestown gas field from six wells.

Twelve wells were spudded during the year; three were drilling on December 31, 1943. Of the nine completions, representing 8,099 feet of hole, three were gas wells, only one of which has been placed on the line. The most active areas were in Scott and Fentress counties.

Late in the year, interest was focused on the Northern Cumberland Plateau where some surface work was done. This area will probably be the most active in the state in 1944.

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DEVELOPMENTS IN CALIFORNIA IN 1943¹

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ABSTRACT

A new high drilling record of 1,429 wells was reached in 1943. One hundred eighty-five wildcat wells were drilled, resulting in 21 new field discoveries. Eighty-six other exploratory wells resulted in 27 new pools and extensions. A disproportionately small reserve was added. Drilling of development wells increased more than 100 per cent over 1942, resulting in a new high record of 1,163 oil wells put on production. The total production of 283,662,445 barrels of oil gave a daily average of 777,166 barrels, a war production increase of 24 per cent over 1941. Exploration activity and wildcat drilling showed a marked upturn.

INTRODUCTION

During 1943 wildcat drilling led to the discovery of 14 new oil fields: Huron (Burrell), Lanare, Pleasant Valley, Enas, McClung, Sharktooth, Tejon, Southeast Greeley, Elberta, Oakridge (Elkins), East Strand, Sterry, Raisin City, and Newport. The 7 new gas fields discovered are Gill Ranch, Lodi, Thornton, Moffat, Herminghaus, Ord Bend, and Colusa. Ten of the discoveries were made as the result of surface and subsurface geology and 11 as the result of geophysical exploration in connection with geological study. Of the latter, 7 were gas fields.

Practically all of the oil exploration took place in the south half of the state where there are producing fields. This was essentially a "combing over" operation to find additional fields in the known oil districts. Far less prospecting had been done in the north part of the state where geophysical discoveries were high in 1943 and where gas only was discovered. In this newer area exploration is a "cream skimming" operation for the type of structural traps which probably would already have been found had the area been subjected to as intensive prospecting as had the south part of the state.

The 1943 figures of 21 discoveries out of 185 wildcats and a success factor of 11.3 per cent are comparable with the 1942 figures of 136 wildcat wells, 7 discoveries, and 5.2 per cent success. Other exploratory efforts seeking new pools and extensions resulted in 86 wells, 28 discoveries, and 32.6 per cent success in 1943 compared with 59 wells, 10 discoveries, and 16.9 per cent success in 1942. Total exploratory footage in 1943 was 1,203,274 feet, of which 798,384 was wildcat footage. In 1942 the total exploratory footage was 903,364, of which wildcatting accounted for 613,595 feet.

In the foregoing classifications "other exploratory effort" includes wells oftentimes referred to as extensions, new-pool tests (deep, shallow, or adjacent), and others in which an exploratory risk existed at the time of drilling. It is impractical

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to sub-classify this group because of lack of agreement on specific definitions by qualified men even when information is adequate. Inability to sub-classify is particularly difficult in case of dry holes where we do not know just what it was the operator did not find. However, the successful results of "other exploratory wells" have been placed under the heading of "Other Exploratory Discoveries" in keeping with the Pacific Section committee's suggestions of a classification of "Exploratory Discoveries" for California. "New Pools" and "Extensions" have been indicated by the use of asterisks.

The entire indicated maximum oil reserve resulting from the 1943 exploratory efforts amounted to only 22 per cent of the 1943 oil production. However, the fact that a number of fault and stratigraphic-trap oil accumulations were found is an indication of the high caliber of scientific talent and management coöperation which was involved.

Increased exploration in two outlying Tertiary marine basins, western Oregon and Washington, and the Imperial Valley, both of which have remained relatively unexplored to date, may lead to discoveries in the future.

DEVELOPMENT

In 1943 the total number of wells drilled reached a new high record of 1,429, of which 223 were dry exploratory wells and 1,163 were placed on production as oil wells. Several gas discovery wells were shut in awaiting connections. The remainder were field-well failures and some shut-in high gas-oil-ratio wells. The total figure of 1,429 is comparable with 765 in 1942.

During 1943, 1,163 wells were completed as oil producers, comparable with 569 in 1942—an increase of more than 100 per cent. The average daily production for 1943 was 777,166 barrels per day compared with 677,073 barrels per day in 1942 and 627,645 barrels per day in 1941. Production during 1943 therefore represents an increase over 1941 of 24 per cent due to war production. It is significant that though the number of oil wells completed declined from 941 in 1941 to 569 in 1942, the production in 1942 nevertheless increased as indicated.

The daily average production rate reached 791,412 barrels per day in the last month of 1943, and the rate was well over 800,000 barrels per day in the first quarter of 1944. Total production for the year 1943 was 283,662,445 barrels.

At the end of 1943 there were 21,192 effective wells in California, a few of which were shut in.

The average net natural gas production for 1942 was 1,151,269 M. C. F. per day compared with 1,302,574 M. C. F. during 1943. The daily increase is roughly equivalent to 25,000 barrels per day of oil on an approximate B.t.u. conversion basis.

FIELDS DISCOVERED

Although the number of discoveries was the highest in several years, the amount of oil discovered was disappointingly small. However, many of the dis-

coveries have a significance unpredictable at this date, and some are more important, as probably pointing the way to large reserves, than they are for themselves intrinsically. They all at least show tangible results of the vigorous geological imagination which is now necessary to find new fields anywhere, and they also show results, just as tangible, of the recognition by management of the modern problem of finding oil. Many of these fields, as well as others of the larger fields in California, such as East Coalinga, would never have been drilled by what has been termed "the contour-minded executive" of the past. Many geologists who have been students of peculiar stratigraphic and structural conditions appertaining to more recent discoveries in California are of the opinion that important reserves measured in billions of barrels are yet to be found by aggressive effort such as that of 1943 of prosecuting the search for stratigraphic and mild structural oil traps. The outstanding incentive for such search, of course, is the East Coalinga field.

The most important discovery of the year was the Pleasant Valley field. This discovery by the Standard Oil Company, a couple of miles southeast of East Coalinga, is believed by many to be the most important of the year as a concrete addition to immediate reserves. It seems the most likely to develop into a major field. After drilling through the top of the Temblor at 6,065 feet, Felix silt at 7,120 feet, Kreyenhagen at 7,390 feet, Green sand at 8,557 feet, Grit bed at 8,565 feet, and Gray Gatchell sand at 8,575 feet, the discovery well P. V. F. No. 82-29F, from 8,724-8,942 feet, penetrated the white kaolinitic impervious permeability barrier cross-cutting the Gatchell sand, and found oil sand between 8,942 and 9,141 feet. With bottom at 9,151 feet and 7-inch cemented at 8,942 feet, the well was completed, February 17, 1943, producing 819 barrels of 28.3° oil daily on a 6½ hour test, cutting 1.9 per cent. There thus seems to be indicated an area of Eocene production generally comparable with the East Coalinga type of production, but with a thinner oil sand and less permeability. The Standard's second well, 28-21F, was completed in August, producing 800 barrels daily. It settled to 507 barrels daily, clean, through 11/64-inch bean. By the end of 1943 six producers had been completed.

IMPORTANT WILDCAT

The wildcat well drilled in Ventura County by R. S. Lytle *et al.* may have a significance far in excess of that of the production discovered.

The well, Elkins No. 1, which drilled through the Oak Ridge overthrust between Grimes Canyon and Shiells Canyon, is of minor importance as a well, but of great significance as an important locale for exploration. The well started in Oligocene Sespe redbeds, but drilled through the thrust fault plane at about 4,625 feet into lower Miocene, and then proceeded down in depth but up the section across another fault into Pliocene at about 5,220 feet and stopped in Pliocene at 5,673 feet. Plugged to 4,914 feet, with 9-inch pipe cemented at 4,808 feet, the well produced Miocene oil of 29.6°, flowing by heads at about 104-116 barrels

daily rate. Several months later, production declined to about 45 barrels daily. The well establishes the presence of oil beneath the Oak Ridge overthrust zone in the prolific Miocene and Pliocene rocks of the Ventura Basin.

IMPORTANT NEW POOLS AND EXTENSIONS

The fact that more than half of the new reserves added as the result of exploration in 1943 came from extensions and discoveries of new pools in old fields indicates that the already discovered oil fields of the state are still an important source of new oil. The discoveries of these types came about primarily as the result of application of subsurface geology, and new oil reserves so found are the result of exploration and not routine drilling or revisions. The finding of more than half of the 1943 reserves associated with old fields shows conclusively that geological study should be actively prosecuted throughout the entire development period of California oil fields. Too often in the past has geology been neglected and valuable geological information overlooked during the development stage. If this were not true, it is unlikely that new pools of up to 100,000-barrel-per-acre magnitude could still be found at drilling depths which have been attainable for more than 30 years and after more than 2,500 wells had been drilled in the field more than 40 years after discovery. Such discoveries were made in 1943.

Many companies have already recognized the significance of these facts and have for a number of years been carrying on geological study in conjunction with field development programs.

It is recognized that some exploratory drilling was postponed where drilling obligations were fulfilled by existing wells, although the operator may have organized sufficient data for exploratory drilling but had no incentive to find more oil on his firmly held properties during the pre-war curtailment period. Furthermore, the results of geological information and study within fields may be reflected in several deals whereby undeveloped rights to producing properties have been acquired.

EXPLORATORY METHODS AND RESULTS

During 1943 ten of the 21 fields discovered were located by geophysical prospecting of which nine were seismograph plays and one a combined gravimeter and seismograph prospect. Next in importance as an exploratory method was subsurface geology with eight new field discoveries. Two new field discoveries resulted from a combination of surface and subsurface geology and the one remaining discovery can be attributed to a combination of subsurface geology and the seismograph. No prospect located on surface geology alone proved productive during 1943.

Not only did the seismograph locate the largest percentage of new fields, but the percentage of success on seismograph plays was high, 27 per cent of those wildcats drilled on such prospects being successful. The reason for this lies in the fact that a large part of the seismograph prospecting was done in the northern San Joaquin Valley and in the Sacramento Valley where relatively little seismo-

graph prospecting had been done until recently and where the area was therefore relatively virgin.

The percentage of success of wildcats drilled on prospects located by subsurface geology was next in order, being 18.2 per cent. Most of these were drilled in areas which had already been subjected to considerable wildcatting in view of which this percentage of success is considered good. Indications are that subsurface geology will continue to be very important in locating wildcat prospects in California.

In addition to the 21 discoveries by drilling, one small new field, East McClung, was discovered by gun perforating in a well abandoned in 1939. This discovery by the Superior Oil Company in well K.C.L.-12, Sec. 3, T. 30 S., R. 26 E., resulted from operations which shortly followed the Continental Oil Company's discovery of the near-by McClung field.

Seismic and gravimeter prospecting was maintained at a high level of activity during 1943. At the beginning of the year 21 seismic parties and 7 gravity parties were operating in California. At the end of the year there were 18 seismic and 9 gravity crews. The magnetometer, soil analysis, and core drilling contributed a relatively small part to the exploratory activity during the year.

The United States Geological Survey started an extensive program in California after the middle of the year to make regional stratigraphic studies which will aid those engaged in the exploration for additional oil and gas reserves. Furthermore, these stratigraphic studies are being carried on within important producing areas where there is yet a deficiency of stratigraphic understanding. This work which is being carried on by a staff of competent geologists complements that done by the industry and will be of great value.

The Survey plans to make the results available in preliminary form as soon as possible.

STRATIGRAPHY

In 1943 the State of California, Department of Natural Resources, Division of Mines, published *Bulletin 118*, "Geologic Formations and Economic Development of the Oil and Gas Fields of California." This is a publication of the Geologic Branch and was prepared under the direction of Olaf P. Jenkins, chief geologist, who secured the cooperation of 126 petroleum geologists and engineers who contributed various chapters. This volume includes stratigraphic sections of most of the oil and gas areas of the state and several chapters which describe and correlate the oil- and gas-producing zones and associated sedimentary rocks of the state. This bulletin will make possible a far more consistent and accurate description and correlation of all matters of stratigraphy which may be encountered in future California development.

TREND IN EXPLORATION

During 1943 perhaps the most important development was a marked increase of exploratory drilling in the northern San Joaquin Valley and the Sacramento

Valley. Not only did the demand for dry gas increase tremendously, thereby increasing interest in prospecting for gas in this area, but also this area was until recently one of those few remaining relatively unexplored in California. This prospective region has now been well covered in a reconnaissance fashion, and additional geophysical work will consist largely of refined detail work, as is now the case in a large part of the prospective regions in and around producing sedimentary basins.

Toward the end of the year several operators were carrying on both surface geology and seismic work in the Imperial Valley in the extreme south part of the state northwest from the head of the Gulf of California. Several wildcats were planned there at the end of the year, and in 1944 this area may become very active.

Exploratory activity has increased in Oregon and Washington. Two wildcats have been drilled by responsible operators in 1943 and more exploratory activity is under way in this area which is one of the few remaining relatively unexplored Tertiary marine basins on the Pacific Coast of the United States.

DEVELOPMENTS IN CALIFORNIA IN 1943

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WILDCAT DISCOVERIES (NEW FIELDS)

County	Field	Location	Operator	Discovery Well	Date	Total Depth (Feet)	Producing Formation	Top Prod. Zone (Feet)	Initial Production	Discovery Method
OIL										
Fresno	Huron	35-16S-18E	Gen. Petrol.	Burrell 68-35	10/16	6,560	Miocene	6,484	342 B/D-151 M.C.F.	Seismograph
"	Lanare	25-17S-18E	Standard	K.P.F. 82-20	5/14	9,355	Tombler	8,042	810 B/D-135 M.C.F.	Seismograph
"	Pl. Valley	20-20S-16E	Standard	P.V.F. 82-20	8/5	6,906	Eocene	6,200	480 B/D-rate	Geology
Kern	Greeley C.	21-15S-17E	Seaboard*	S.T.U. 53-14	12/2	11,600	Eocene	11,470	F 303 B/D-271 M.C.F.	Seismograph
"	Raisin City	14-15S-17E	Standard	Wegia Comm. 1	12/2	11,600	Vellder	8,132	1,368 B/D rate	Sels. & geol.
"	E. Strand	21-20S-26E	Standard	K.C.L. 36-8	1/17	8,351	Stevens	1,085	164 B/D rate	Sels. & geol.
"	Enas	8-30S-26E	T.W.A.	Enas 6	6/21	3,457	Chavac	295 B/D	30 B/D	Geology
"	McClung	21-27S-27E	Continental	K.C.L. G-1	9/13	8,134	Stevens	9,085	130 B/D	Geology
"	McCung†	4-30S-26E	Superior	K.C.L. 12	12/2	13,131	Vellder	4,422	124 B/D rate	Geology
"	Sharktooth	3-30S-26E	Richfield	Big Mills 1	9/15	4,435	U. Miocene	3,104	216 B/D hrs.	Geology
"	Tejon	35-11N-10W	Los Nietos	Scott 1	12/16	3,355	U. Miocene	3,104	216 B/D	Geology
S. L. Obispo	E. Elberta	15-12S-13E	Los Nietos	Sterry 101	10/24	5,073	U. Miocene	4,460	46 B/D	Geology
Los Angeles	Serry	18-3N-17W	Bankline	Tow. Lands 1	5/26	2,424	U. Miocene	2,304	50 B/D	Geology
Orange	Newport	20-6S-10W	Elliot	Elliot 1	2/17	5,073	Miocene	4,808	116 B/D	Geology
Ventura	"Elkins"	6-3N-10W	Lytle et al.	Elkins 1						
GAS										
Colusa	Orda	15-16N-1W	Gen. Petrol.	Capital 1	12/6	3,460	Cretac.	2,840	3,200 M.C.F.	Seismograph
Glenn	Ord Rend	15-10N-1W	Seaboard	K.P.F. 82-20	8/14	9,355	Cretac.	8,042	810 M.C.F.	Seismograph
Madera	Gill Ranch	16-15S-16E	Texas	Gill 38-16	12/8	5,066	Eocene	4,415	11,000 M.C.F.	Seismograph
"	Herminghaus	18-3S-16E	Shell	Gill 38-16	12/8	5,066	Eocene	4,415	11,000 M.C.F.	Seismograph
"	Mofat	7-12S-15E	Texas	Mofat 1-7	9/13	4,408	Eocene	3,080	7,070 M.C.F.	Seismograph
Sacramento	Thornton	36-5N-5E	Amerada**	Capital 1	7/2	8,367	Eocene	3,355	6,800 M.C.F.	Seismograph
San Joaquin	Lodi	9-4N-7E	Amerada**	Lodi-Comm. 9-1	4/3	4,471	Eocene	2,040	7,200 M.C.F.	Grav. & sels.

* Joint venture—Seaboard-Tide Water-Union.

** Joint venture—Amerada-Bankline-Honolulu.

† May be an extension.

‡ Old well—discovery by gun perforating.

CALIFORNIA DISCOVERY STATISTICS—1943 (continued)

OTHER EXPLORATORY DISCOVERIES (NEW POOLS AND EXTENSIONS)

County	Field	Location	Operator	Discovery Well	Date	Total Depth (Feet)	Producing Formation	Top Prod. Zone (Feet)	Initial Production
Contra Costa	Rio Vista	20-3N-3E	Standard	Jordan Unit 1	1/20	4,270	Emigh	4,142	5,173 M.C.F./D
Fresno	Helm*	8-17S-18E	Amerada	Whit'le R.F. 21-8	6/10	8,233	Tombler	6,620	F 1,037 B/D
"	Riverdale*	22-17S-19E	Amerada	Clemente 52-22	6/22	7,085	Eocene	7,020	F 244 B/D
"	Riverdale	16-17S-19E	Amerada	Young 84-16	8/27	7,060	Eocene	7,860	F 203 B/D 400 M.C.F.
"	Raisin City	10-15S-17E	Shell	San Joaquin 1-1	10/4	6,376	Tombler	4,975	F 2,400 B/D
"	Rein	8-17S-18E	Amerada	Whit'le R.F. 21-8	5/21	8,233	Eocene	7,992	130 B/D
"	Chingua, West	8-17S-18E	Amerada	Whit'le R.F. 21-8	5/21	8,233	Eocene	7,992	130 B/D
"	Republic Midway	6-12S-15E	C.C.M.O.	Well 70-60 gas 11A	6/21	4,885	Maricopa	2,940	130 B/D
Kern	Edison	16-30S-20E	C. L. Zastrow	Well 16-38	10/10	4,885	Mid. Miocene	4,763	P 510 B/D rate
"	Midway	12-31S-22E	The Texas Co.	Visalia 12-5	10/15	1,774	Tulare	1,200	P 38 B/D
"	Sunset	33-31S-23E	Standard	Well 27-33B	11/16	4,563	Etchegoin	4,195	P 147 B/D
Los Angeles	Aliso Canyon	18-11N-23W	Petromont	P-Mr	7/24	1,437	Etchegoin	1,104	P 125 B/D
"	Oak Canyon	28-3N-16W	T.W.A.	Sesnon 1-2	9/1	8,521	Porter No. 12	5,548	F 1,555 B/D
"	Segundo Bch.*	32-5N-17W	Western Gulf	Glumore Fee-1	12/16	7,495	Porter No. 12	5,548	F 1,555 B/D
"	Hilgundo Bch.*	7-35S-4W	Standard Ex.	Sought Gas Zones	8/15	3,410	Porter No. 12	5,548	F 1,555 B/D
Orange	Richfield*	34-5S-9W	Standard	A.U.W. Co. 2-1	8/8	3,683	Porter No. 12	5,548	F 1,555 B/D
"	Seal Beach*	11-5S-12W	Helman Estate	Fee No. 1A	5/4	6,815	Porter No. 12	5,548	F 1,555 B/D
"	Norwing**	15-0N-33W	Standard	Lloyd Comm. 1	2/19	7,250	Porter No. 12	5,548	F 1,555 B/D
Santa Barbara	Los Flores	1-8N-33W	Pacific Western	Los Alamos 19	1/23	5,716	Porter No. 12	5,548	F 1,555 B/D
Sacramento	Rio Vista*	4-3N-3E	Standard-Texas	Midland Fee 5	8/3	5,360	Porter No. 12	5,548	F 1,555 B/D
"	Thornton	28-5N-5E	Amerada	Hausken Comm. 1	9/13	6,003	Porter No. 12	5,548	F 1,555 B/D
"	Ventura A-4†	1-4N-0E	Bankline	Comm. 1-1	4/26	5,708	Porter No. 12	5,548	F 1,555 B/D
San Joaquin	Ventura A-4†	28-3N-23W	General Petrol.	Barnard 4 A	3/1	5,078	Porter No. 12	5,548	F 1,555 B/D

* New pool.

** This may be a new field.

† Discovery by perforating incidental to remedial cement job.

RESULTS OF EXPLORATORY DRILLING.—TABLE I, DRY HOLES

Exploration Method used to locate WILDCAT Prospect	No. of Holes Drilled			WILDCAT DRY HOLES Footage Drilled			Average Depth		
	1942	1943	Change	1942	1943	Change	1942	1943	Change
Surface Geology	37	38	2	145,044	161,882	16,838	3,920	4,260	340
Subsurface Geology	32	36	4	113,804	127,749	13,945	3,550	3,550	0
Subsurface and Surface Geology	9	16	7	51,789	60,578	8,789	5,750	3,785	-1,965
Total Geology	78	90	12	310,637	350,209	39,572	3,980	3,800	-180
Seismograph	23	27	4	162,174	164,326	2,152	7,050	6,085	-965
Seismograph and Subsurface Geology	2	6	4	18,075	45,385	27,310	9,035	7,565	-1,470
Seismograph and Surface Geology	0	2	2	0	11,072	11,072	0	5,535	5,535
Random Drilling	24	40	16	57,167	112,666	55,499	2,380	2,815	435
Core Drilling	2	0	-2	14,312	0	-14,312	7,155	0	-7,155
Total—Wildcat	129	165	36	562,365	683,658	121,293	4,359	4,140	-219
DRY HOLES OTHER THAN WILDCATS									
Total—Exploratory OTHER THAN WILDCATS	49	58	8	216,628	265,563	48,935	4,421	4,579	158
GRAND TOTAL—Exploratory Wells	178	223	45	778,993	949,221	170,138	4,376	4,256	-120

RESULTS OF EXPLORATORY DRILLING.—TABLE II, DISCOVERIES

Exploration Method used to locate WILDCAT Prospect	No. of Holes Drilled			WILDCAT DISCOVERIES Footage Drilled			Average Depth		
	1942	1943	Change	1942	1943	Change	1942	1943	Change
Surface Geology	2	0	-2	11,871	0	-11,871	5,935	0	-5,935
Subsurface Geology	0	8	8	0	32,846	32,846	0	4,105	4,105
Subsurface and Surface Geology	0	2	2	0	8,826	8,826	0	4,413	4,413
Total Geology	2	10	8	11,871	41,672	29,801	5,935	4,167	1,295
Seismograph	2	10	8	15,221	64,703	49,482	7,610	6,470	-1,140
Seismograph and Subsurface Geology	2	1	-1	21,798	8,351	-13,447	10,899	8,351	-2,548
Seismograph and Surface Geology	0	0	0	0	0	0	0	0	0
Random Drilling	0	0	0	0	0	0	0	0	0
Core Drilling	1	0	-1	2,340	0	-2,340	2,340	0	-2,340
Total—Wildcat	7	21	14	51,230	114,726	63,496	7,319	5,460	-1,859
DISCOVERIES OTHER THAN WILDCATS									
Total—Exploratory OTHER THAN WILDCATS	10	28	18	73,141	139,327	66,186	7,314	4,905	-2,409
GRAND TOTAL—Exploratory Wells	17	49	32	124,371	254,053	127,682	7,316	5,185	-2,131

RESULTS OF EXPLORATORY DRILLING.—TABLE III, TOTALS

Exploration Method used to locate WILDCAT Prospect	Footage Drilled			WILDCAT WELLS (Total) No. of Holes Drilled			DISCOVERY PERCENTAGE			
	1942	1943	Change	1942	1943	Change	1942	1943	1942	1943
							Footage		No. of Holes	
Surface Geology	156,915	161,882	4,967	39	38	-1	7.5	0.0	5.1	0
Subsurface Geology	113,804	160,595	46,791	32	44	12	0.0	20.5	0	18.2
Subsurface and Surface Geology	51,789	69,404	17,615	9	18	9	0.0	12.7	0	11.1
Total Geology	322,508	391,881	69,373	80	100	20	3.7	10.6	2.5	10.0
Seismograph	177,395	228,939	51,544	25	37	12	8.6	28.3	8.0	27.0
Seismograph and Subsurface Geology	39,873	53,730	13,857	4	7	3	54.5	15.5	50.0	14.3
Seismograph and Surface Geology	0	11,072	11,072	0	2	2	0	0	0	0
Random Drilling	57,167	112,666	55,499	24	40	16	0	0	0	0
Core Drilling	16,652	0	-16,652	3	0	-3	14.1	0	33.3	0
Total—Wildcat	613,595	798,384	184,789	136	186	50	8.4	14.4	5.2	11.3
TOTAL EXPLORATORY OTHER THAN WILDCATS										
Total—Exploratory OTHER THAN WILDCATS	289,769	404,890	115,121	59	86	27	25.2	34.4	16.9	32.6
GRAND TOTAL—Exploratory Wells	903,364	1,203,274	299,910	195	272	77	13.8	21.1	8.7	18.0

Note: All changes above are increases unless indicated by a minus sign.
Tables I, II, and III prepared for the Petroleum Administration for War by A. I. Gregersen.
All figures refer to California except one dry wildcat drilled in Arizona.

DEVELOPMENTS IN EASTERN INTERIOR BASIN IN 1943¹

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ABSTRACT

Drilling in the Eastern Interior basin declined slightly in 1943 and production of oil declined 20 per cent. There were no major discoveries and little deep exploratory drilling. Prospects for 1944 are for a continued decline of drilling activity unless there is a major discovery, a price rise, or a relaxation of well spacing restrictions accompanied by an adequate supply of materials and manpower.

INTRODUCTION

Drilling in the Eastern Interior basin in 1943 continued at nearly the same rate as in 1942. Forty-nine new pools were discovered, all of them small, and the new reserves found amount to only a fraction of the basin's 1943 production of 94,528,000 barrels. The production was 6.3 per cent of the total for the United States.

The Eastern Interior basin (Fig. 1) comprises about four-fifths of Illinois plus the adjoining parts of Indiana and Kentucky and has a total area of approximately 50,000 square miles. Oil production is largely confined to the south half of the basin.

DEVELOPMENT

Nearly as many wells were drilled for oil and gas in the Eastern Interior basin in 1943 as in 1942, or a total of 2,473 as compared with 2,518, which is a decline of less than 2 per cent. The following table shows the distribution by states.

	<i>Number of Completed Wells</i>	
	1942	1943
Illinois.....	2,017	1,792
Southwestern Indiana.....	315	465
Western Kentucky.....	186	216
	<hr/> 2,518	<hr/> 2,473

The total oil production from the Eastern Interior basin in 1943 amounted to 94,528,000 barrels as compared with 117,671,000 barrels in 1942, a decline of 20 per cent. Illinois produced 82,260,000 barrels, of which it is estimated that approximately 91 per cent came from Mississippian strata, four per cent each from Pennsylvanian and Devonian strata, and one per cent from Ordovician strata. This represents a decline of 23 per cent from the 1942 production of 106,590,000 barrels.

Production in Kentucky west of the Cincinnati arch increased from 4,273,616 barrels in 1942 to approximately 7 million barrels in 1943, an increase of 64 per cent. In Southwestern Indiana production decreased from 6,641,000 barrels in 1942 to 5,273,000 barrels in 1943, a decline of 21 per cent.

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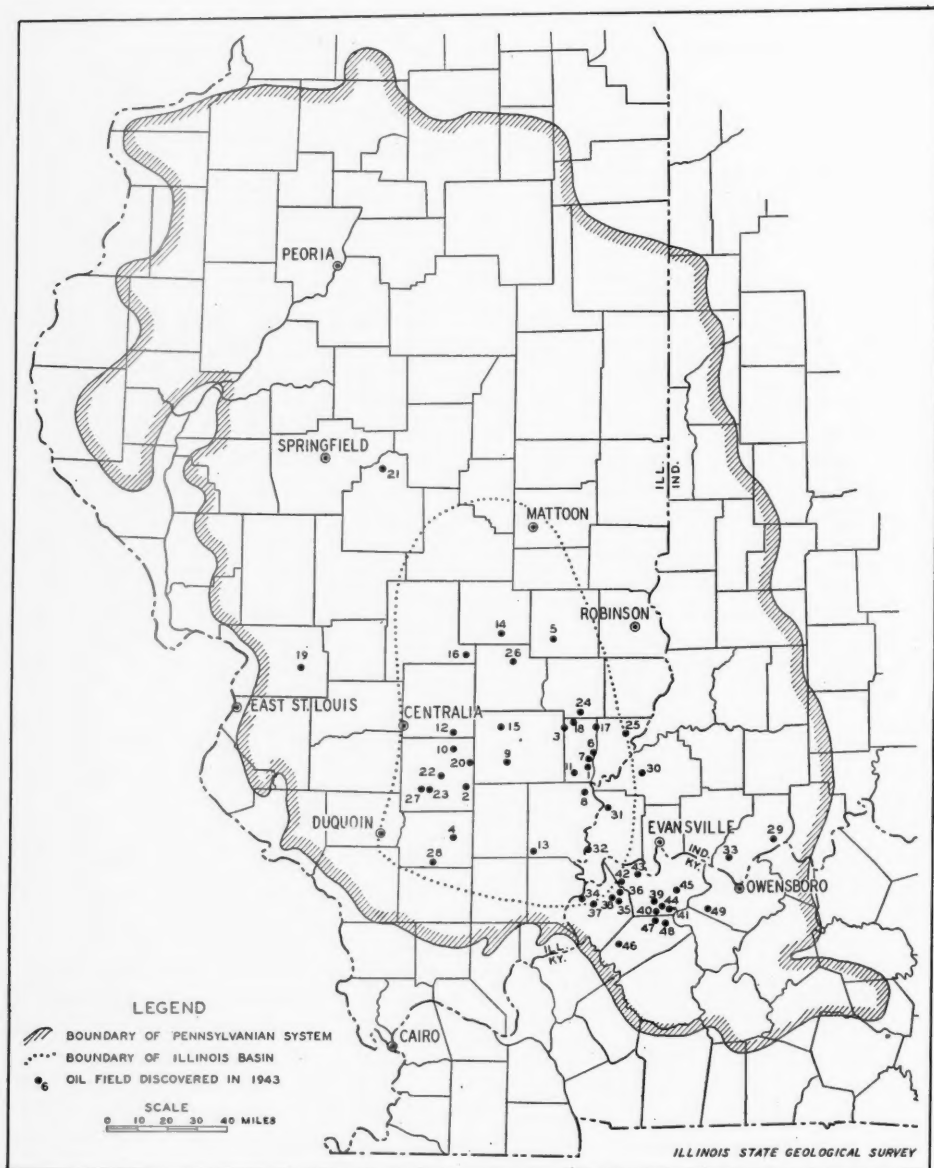


FIG. 1.—Map of Eastern Interior basin showing new oil pools discovered in 1943. For list of pools see Table I.

The distribution of 1943 wildcat drilling with respect to the Illinois basin (central deep part of Eastern Interior basin) was similar to that in 1942; that is, the great majority of the discovery wells were drilled in the deep part of the basin.

NEW FIELDS DISCOVERED

As shown in Table I, 49 new oil pools were discovered in 1943 in the Eastern Interior basin of which 28 are in Illinois, 5 are in Indiana and 16 are in Kentucky. The most noteworthy of these as indicated by the number of wells producing at the end of the year are: Calvin North, White County, Illinois, with 23 wells, total production to end of 1943, was 128,000 barrels; Maple grove, Edwards County, Illinois, with 14 wells, total production to end of 1943 was 46,000 barrels; North Owensville, Gibson County, Indiana, with 9 wells; St. Vincent, Union County, Kentucky, 18 wells; Hitesville, Union County, Kentucky, 10 wells; and Poole, Henderson County, Kentucky, 13 wells.

The Marine pool, Madison County, Illinois, the discovery well for which was completed July 20, 1943, is of special interest because it is a new Silurian limestone pool located about 40 miles west of the Illinois basin. It is the second Silurian limestone oil pool to be discovered recently in Illinois. The Marine pool was discovered by a seismograph survey. At the end of 1943 there were four producing wells in the pool and a proved area of 200 acres. A preliminary study of well data indicates a dome in the Devonian-Silurian strata having possibly 40 or 50 feet of closure, roughly circular in outline, and occupying an area somewhat more than one square mile. Average depth to the top of the Silurian limestone is approximately 1,730 feet. The producing zone consists of porous dolomitic limestone containing many corals typical of Niagaran reef rock. Overlying the Silurian limestone is approximately 20 feet of Devonian limestone. Initial productions of the better wells are from 200 to 300 barrels.

ILLINOIS

New producing formations.—Additional producing formations discovered in Illinois oil pools in 1943 numbered 51, of which 13 are deeper than the previous producing zone or zones and 38 are shallower. Of the 51 discoveries of additional producing formations, 4 were Pennsylvanian, 25 Upper Mississippian (Chester series), 21 Lower Mississippian (Iowa series), and 1 Devonian. The first discovery of oil production in the Silurian in Illinois was the Mt. Auburn pool, Christian County (Table I, line 21). There were no discoveries of Ordovician or deeper production during 1943.

Extensions.—Extensions to pools discovered by outpost wells ($\frac{1}{4}$ mile to 2 miles from nearest production) in 1943 in the Eastern Interior basin number 69, of which 66 are in Illinois, 1 is in Indiana, and 2 are in Kentucky. Because of their number and close spacing, they are not shown on the map. Of the 66 pool extensions in Illinois, 63 are in 10 counties in the Illinois basin (which is outlined

TABLE I
POOLS DISCOVERED IN EASTERN INTERIOR BASIN IN 1943

Index Number on Map	Pool	County	Company and Farm	Location	Total Production (Feet)	Depth to Top of Producing Formation (Feet)	Initial Production (Barrels) Well	Date of Completion of Discovery Well	Reported Method of Location of Discovery Well	Number of Wells Producing in Field	Jan. 4, 1944
Discovery Well											
1	Albion East	Edwards	Mabee Oil and Gas—Cowling	SW NE SW 20-2S-14W	3,038	2,991	180	8-10-43	G	7	
2	Belle River	Jefferson	Mohawk Drig Co.—Waters et al.	C NE NE 27-3S-4E	3,089	3,078	366	1-12-43	G-Gr	5	
3	Bennington	Edwards	Burr Lambert—Burr Lambert	NW SE NW 18-1N-10E	3,172	3,131	120	2-9-43	G	2	
4	Bessie	Franklin	Ohio Oil—U. S. Coal and Coke	NE NE NW 13-6S-3E	3,459	3,020	80+44	6-8-43	S	1	
5	Bogota	Jasper	Big Chief Drig.—Heap	C SE SE SW 28-6N-0E	3,213	3,109	152	8-17-43	S	6	
6	Browns	Edwards	Superior—Lipper	NW NE SW 28-1S-14W	3,091	2,602	209+34	11-23-43	S	1	
7	Browns South	Edwards	Superior—Lipper	SE SE SE 5-2S-14W	3,142	2,836	16+34	11-23-43	S	1	
8	Calvin North	White	N. V. Duncan—Metcalfe	SW SW NE 31-3S-14W	2,828	2,817	70	2-10-43	G	23	
9	Covington South	Wayne	Deep Rock Oil—Bullington et al.	C NE SW 12-2S-6E	3,305	3,315	223+14	1-12-43	S-G	7	
10	Divide	Jefferson	Ball Breda—Indiana Natl. Bank	E/2 NE NE 24-1S-3E	2,881	2,723	264	10-19-43	G	3	
11	Ellery South	Edwards	Deep Oil Co.—Sutton	S/2 NW SW 33-2S-10E	3,352	3,303	416 (Flow.)	9-14-43	S	2	
12	Exchange	Marion	Gulf—Floyd	SE SE NW 25-7N-3E	2,763	2,734	155+14	9-14-43	S	2	
13	Gossett	White	Smokey—Delap	SE SE NE 8-7S-8E	3,086	3,080	14	10-26-43	G	1	
14	Hill	Efingham	Williams—Bushue	SW NW 16-6N-6E	2,653	2,571	245+25	10-5-43	S-G	2	
15	Johnsonville North	Wayne	Texas Co.—Hoffee	NE NE NE 9-1N-6E	3,332	3,192	140	11-23-43	S	1	
16	La Clede	Fayette	Central Pipe Line—Littleton	NE SW 22-3N-4E	2,359	2,356	27+63	11-23-43	G	1	
17	Lancaster West	Edwards	First Natl. Pet. Trust—E. Myers	NE NW NW 11-1N-14W	2,873	2,857	961 (Flow.)	7-27-43	G	2	
18	Maple Grove	Edwards	Ill. Prod. Corp.—Barber	E/2 NE SW 4-1N-10E	3,301	3,271	83	6-20-43	G	14	
19	Marine	Madison	Rockhill Oil—L. Mayer	SE NW SW 15-4N-6W	2,590	1,727	14+3	7-20-43	S	4	
20	Markham City North	Jefferson	W. Marlow et al.—Dalton Comm.	SE SW 13-2S-4E	3,132	3,113	517	9-28-43	Gr-S	7	
21	Mt. Auburn	Christian	W. Marlow et al.—Magnaolia Pet.	S/2 NE NE 27-1S-1W	1,905	1,900	22	3-23-43	G	1	
22	Mt. Vernon	Jefferson	Magnaolia Pet.—Murchison—Sledge	SW NE NE 18-3S-3E	2,693	2,684	60+19	8-3-43	S	5	
23	Nason	Jefferson	Murchison—Sledge	SE SE SE 34-3S-2E	2,805	2,766	33	12-17-43	G	1	
24	Parkersburg West	Richland	Martin—Boyd	S/2 SE SW 26-2N-10E	3,057	3,252	340	9-21-43	G	2	
25	Patton West	Wabash	Shell—Thripp	SW SW NW 20-1N-12W	2,411	2,356	207+121	8-3-43	G	4	
26	Tolliver East	Clay	Obering—McGee	NE NE SW 30-5N-7E	2,847	2,838	300	9-7-43	S-G	1	
27	Waltonville	Jefferson	Byars & Ellison—E. S. Adkins	SE SW NW 32-3S-2E	2,766	2,466	38+40	5-2-43	G	1	
28	West Frankfort South	Franklin	E. S. Adkins—Browns Estate	SE NE NW 25-7S-2E	2,875	2,795	182	4-6-43	G	8	

TABLE I—(Continued)

Index Number on Map	Pool	County	Company and Farm	Location	Total Depth (Feet)	Depth to Top (Feet)	Producing Formation	Initial Production (Barrels) ^a	Date of Completion of Drilling Wells	Reported Method of Locating Drilling Wells	Number of Wells Producing in Field
INDIANA											
29	N. Owensville	Gibson	Superior Oil—S. B. Thompson 1	SE NW 25-S-12-W	2,454	2,411-17	McClosky ls.	187	2-23-43		Dec. 31, 1943 9
30	Rogers	Posey	Superior Oil—J. W. Carr et al 1	NE SW 20-6S-13W	2,063	1,885-90	Clote sand	32 oil			
31	Upton	Posey	Bennett Bros. Drig. Co.—John W. Spencer 1	SE SW 32-6S-14W	2,150	2,143-50	Tar Springs ss.	133 water 115 oil	1- 6-43		1
32	Newtonville	Spencer	Wm. B. Bateman 1	NW SW 8-6S-4W	802	798-802	Jackson	20 water	12-22-43		1
33	Unnamed	Spencer	L. Justice—John Ernst 1 L. Justice—Clyde A., Flora Richards 1	NE SE 11-7S-4W	1,548	1,541-45	McClosky ls.	4	11-10-43 12- 8-43		1
WESTERN KENTUCKY											
34	Raleigh	Union	Porter Evans.—B. Boswell 1	14-O-18	2,854	2,736-62	Aux Vases ss.	127	10-27-43		Dec. 31, 1943 3
35	St. Vincent	Union	Whebert & Fure—G. & F. Greenwell 2	9-O-20	2,675	2,556-59	Lower O'Hara McClosky ls.	318	6-20-43		18
36	Hitesville	Union	Carter—Russellberg 1	24-P-21	1,713	1,706-13	Waltersburg ss.	182	7- 7-43		10
37	Morganfield	Union	Trans-Tex—Newman 1	13-O-19	2,755	1,426-40	Pennsylvanian sand	110	5-10-43		8
38	Chapman	Union	Luhings—Spalding 1	4-O-20	2,730	2,046-32	McClosky ls.	47	12-20-43		1
39	Cairo	Henderson	Carter—Cottingham 1	17-O-23	1,867	1,706-1,807	Waltersburg ss.	119	6-30-43		1
40	Poole	Henderson	Browning—Strum 1	9-N-23	1,976	1,951-68	Tar Springs ss.	135	6-2-43		13
41	Greensboro	Henderson	Carter—DeVasher 1	24-O-24	2,655	2,499-2,504	McClosky ls.	113	7-14-13		1
42	Utley	Henderson	Waller & Shirella—Willett 1	16-P-21	2,585	2,579-58	McClosky ls.	232	2-24-43		2
43	Geneva	Henderson	Wood—H. S. Denton 1	13-P-21	2,317	1,966-49	Benoist ls.	120	2-24-43		0
44	Clay	Henderson	Carter Oil—S. T. Denton 1	25-P-25	2,616	2,184-89	Benoist ls.	120	2-27-43		0
45	Zion	Henderson	Carter Oil—Barratt 1	25-P-25	1,375	1,227-46	Aux Vases ss.	149	2-27-43		0
46	Clay	Webster	Shamrock—Clark 1	23-M-21	2,375	2,236-48	Pennsylvanian sand	27	0-23-43		2
47	East Poole	Webster	Sinclair Oil Co.—Higginson 1	10-N-23	2,596-7,602	Cypress ss.	McClosky ls.	165	7-14-43		1
48	Pratt	Webster	Hamilton—Sellars 1	14-N-24	1,802	1,872-84	Tar Springs ss.	175	8-11-43		7
49	Panther	Daviess	Miller & Shirella—T. P. Miller 1	10-N-27	1,009	1,833-69	Benoist ss.		6-2-43		4

^a Oil and water (pumping unless otherwise indicated).

G—subsurface geology.

S—seismograph.

Gr—gravimeter.

TABLE II
IMPORTANT DRY TESTS IN 1943

County	Location	Company and Farm	Total Depth (Feet)	Deepest Formation	Depth to Top (Feet)	Date Completed
1 Bond	20-5N-4W	Aetna Oil—M. Spengel 1	3,000	"Trenton"	2,941	7-27-43
2 Bond	14-6N-2W	E. Burgard—Klaus 1	2,460	Devonian	2,425	3- 8-43
3 Champaign	1-22N-7E	R. F. G. Drlg.—Reynolds 3	324	Silurian		6- 1-43
4 Christian	26-15N-2W	Wainright—Bernard 1	2,000	Devonian	1,926	8-31-43
5 Clinton	7-15-SW	Smokey Oil—J. Friedrich 1	2,741	"Trenton"	2,698	1-26-43
6 Clinton	3-2N-4W	Eason Oil—Schuette 1	3,171	"Trenton"	3,102	3- 2-43
7 Clinton	15-1N-4W	Derby Oil—Conrad Houkap 1	3,287	"Trenton"	3,249	3- 9-43
8 Clinton	22-1N-2W	Wiser Oil—M. Wessel 1	2,815	Devonian	2,700	7- 6-43
9 Clinton	22-2N-1W	Black and Pearson—H. Kluth 1	3,028	Devonian	2,916	7-13-43
10 Clinton	20-3N-2W	P. Mosebach—M. B. Skidmore 1	2,679	Devonian	2,571	0- 7-43
11 Coles	35-14N-7E	Continental—Minno Daily 1	3,172	Devonian	2,940	6-29-43
12 Crawford	11-8N-12W	Ryan Oil (Powers-Krohn)—Boyer 1	2,890	Devonian	2,590	12- 7-43
13 Douglas	31-15N-10E	S. J. Burkett—W. L. Worley 1	1,216	Silurian	1,178	8-17-43
14 Edgar ¹	1-13N-14W	Tom Poppasetal—J. O. Halland 1	2,212	"Trenton"	2,165	6-22-43
15 Fayette	28-9N-1E	Northern Ordnance, Inc.—M. O'Conner 1-D	3,140	Devonian	2,987	4-20-43
16 Ford	10-24N-7E	Nelson, Urp, Stroh—J. Urp 1	3,955	Eau Claire	3,805	7-20-43
17 Ford	1-28N-9E	A. C. Murray—Paulsen 1	720	"Trenton"	600	1- 4-44
18 Fulton	17-6N-1E	J. L. Smith—Bradley 1	1,130	St. Peter	1,116	8- 3-43
19 Greene	30-11N-13W	D. S. Brooks—Valley Farms 2	765	St. Peter	756	5-25-43
20 Hancock	20-3N-5W	Dale Hopkins—K. H. Slater 1	673	Devonian	620	11- 9-43
21 Henderson	14-9N-14W	Newhall Corp.—Hanna 1	610	Maquoketa	416	3- 2-43
22 Henderson	8-8N-5W	C. D. Kidder—C. H. Carpenter 1	530	Devonian	365	4- 6-43
23 Jefferson	27-3S-3E	Nash Redwine—Prudential Life Ins. 1	4,759	Devonian	4,536	4- 6-43
24 Kankakee	2-20N-12W	Ste. Anne Pet.—V. A. Cote 1	780±	"Trenton"		3- 9-43
25 Madison	11-3N-6W	C. G. Smith—Michael 1	2,548	"Trenton"	2,514	4-13-43
26 Madison	12-3N-9W	J. Kesi—Gargac 1	1,370	Devonian	1,262	1-19-43
27 Madison	21-5N-6W	R. Powers-Kaulman—Isenburg 1	2,373	"Trenton"	2,452	1-12-43
28 Madison	33-4N-7W	L. Alch—Gusewelle 1	2,370	"Trenton"	2,269	3- 9-43
29 Madison	20-5N-5W	Kingwood—J. E. Niegli 1	2,715	"Trenton"	2,618	2-23-43
30 Madison	23-3N-5W	McCollough—Blacet 1	2,948	"Trenton"	2,852	4-27-43
31 Marion	14-3N-1E	Shell Oil—Sugg Heirs 1	3,344	Devonian	3,245	2- 2-43
32 Mason	19-22N-6W	E. W. Hayes—Null 1	1,401	"Trenton"	1,289	6- 1-43
33 Monroe	13-3S-10W	Vawter & Braun—Dill 1	965	"Trenton"	904	7- 6-43
34 Montgomery	35-11N-5W	Central Pipe Line—Gees 1	2,467	"Trenton"	2,408	9-28-43
35 Montgomery	31-8N-5W	W. R. Holmes—Monke 1	752	Pottsville	600	4-13-43
36 Montgomery	28-8N-5W	W. R. Holmes—Sewing 1	699	Pennsylvanian	565	6- 8-43
37 Montgomery	32-11N-5W	Myers & Duff—Keys 1	652	Pennsylvanian	11-	2-43
38 Moultrie	13-15N-6E	Continental Oil—J. L. Beachy 1	3,681	"Trenton"	3,518	4-20-43
39 Perry	36-4S-2W	Texas—J. Matlavish 1	4,119	"Trenton"	3,984	3-23-43
40 Pike	14-5S-6W	Mineral Develop.—G. S. Hyde 2	621	"Trenton"	466	9-28-43
41 Putnam	3-31N-1W	Fuller & Turner—McGhiey 1	2,000	New Richmond	1,940	8-10-43
42 Randolph	25-5S-5W	Southwestern Ill. Coal Corp.—Cleland 1	2,566	Devonian	2,466	12-14-43
43 St. Clair ²	28-1N-10W	Tarleton <i>et al.</i> —Dyloff 1-A	1,800	New Richmond	1,614	4- 6-43
44 St. Clair	16-2N-6W	Big Four Oil & Gas—Voges 1	2,095	"Trenton"	2,494	3- 2-43
45 St. Clair	17-2S-8W	H. C. Robertson <i>et al.</i> —Karban 1	1,480	"Trenton"	1,410	2-23-43
46 St. Clair	18-1S-6W	D. S. Hager—Klingie 1	2,363	"Trenton"	2,257	3- 9-43
47 St. Clair	4-1S-8W	Eason Oil—E. Thomas 1	2,174	St. Peter	2,157	3-30-43
48 St. Clair	24-2S-6W	J. Vetch—M. Lange 1	2,745	"Trenton"	2,632	3-30-43
49 St. Clair	24-1S-9W	N. W. Whitton—G. Grossman 1	1,505	"Trenton"	1,427	5-25-43
50 St. Clair	31-1S-8W	H. Gass—A. Englerth 1	1,605	"Trenton"	1,522	7-20-43
51 St. Clair	29-1N-6W	Eason <i>et al.</i> —Engle 1	2,452	"Trenton"	2,340	8-31-43
52 St. Clair	32-2N-7W	W. P. Muller—Smiley 1	1,990	"Trenton"	1,946	8-24-43
53 Sangamon	15-15N-3W	Davis—Taft 1	1,850	Silurian	1,787	12-14-43
54 Sangamon	21-15N-3W	O. A. Reed <i>et al.</i> —C. Ross 1	2,314	"Trenton"	2,217	12-28-43
55 Shelby	21-10N-4E	W. Duncan—H. H. Hoskins 1	3,236	Devonian	3,110	7-27-43
56 Shelby	18-11N-6E	Texas—Ferguson 1	3,534	Devonian	3,345	12-28-43
57 Union	35-11S-1W	Little Egypt Oil—Basler 1	4,953	"Trenton"	3,999	9-21-43
58 Warren	31-8N-1W	King & Heiser—M. Gren 1	810	Maquoketa	742	3-30-43
59 Washington	32-2S-4W	Texas—C. L. Kokesh 1	2,485	Devonian	2,330	6-22-43
60 Washington	0-1S-4W	Fisher Oil <i>et al.</i> —J. Rossell 1	2,646	Devonian	2,340	7-20-43
61 Will	21-35N-9E	Brown & Feltis—Gardner 1	900	Platteville		6- 8-43

¹ In Warrenton—Borton pool.

² In Dupo pool.

in Figure 1), 2 are in marginal counties (one each in Bond and Coles), and only one in all outside counties (Marine pool, Madison County).

Important wildcats and deep tests.—Important dry wildcats and deep tests in pools numbered 61 (Table II). It will be noted that there was little deep testing

in the Illinois basin, and that tests which penetrated Ordovician rocks (Maquoketa, "Trenton," St. Peter, New Richmond) are located in areas marginal to the Illinois basin. The drilling of numerous "Trenton" tests in Madison and St. Clair counties and the adjacent territory was stimulated by the discovery of the St. Jacob pool in Madison County in 1942 which produces from the "Trenton." Up to the end of 1942 the St. Jacob pool had produced a total of 685,000 barrels of oil from 27 wells.

Exploratory methods and results.—Subsurface geology and the reflection seismograph continue to be the methods most used in the location of exploratory wells. For the 28 new pools discovered in Illinois in 1943, it was reported that the discovery wells of 14 were located on the basis of subsurface geology, 9 on seismograph surveys, 3 on a combination of seismograph and subsurface geology, one on a combination of gravimeter and seismograph, and one subsurface geology and gravimeter (Table I).

The amount of seismograph work in Illinois in 1943 was only about half of that in 1942. In January, 1943, 11 seismograph parties were active in Illinois and in June, 6 parties were active. There was some activity in gravimeter, magnetometer and soil analysis surveys.

Trend in exploration and development.—There has been a gradual downward trend in the number of exploratory wells drilled in Illinois in the past 2 years. In 1943, in Illinois, 243 wildcat wells located more than 2 miles from production were drilled as compared with 334 in 1942. Of these, 28 (11.5 per cent) were successful, as compared with 40 (12 per cent) in 1942. In 1943, in Illinois, 217 outpost wells were drilled, of which 66 (30 per cent) were successful in discovering pool extensions. This may be compared with 215 outpost wells in 1942 of which 48 (22 per cent) were successful.

Pool development drilling declined about 8 per cent in 1943 when 1,349 wells were drilled for oil and gas in pools as compared with 1,468 wells in 1942. Of the pool development wells completed in 1943, 996 were oil or gas producers as compared with 1,092 in 1942.

It seems probable that the rate of drilling, both for exploratory and development wells, will continue to decline slowly unless there is a major discovery, a price rise, or a relaxation of federal well spacing restrictions accompanied by an adequate supply of equipment and manpower.

There are signs of increasing interest in the possibilities of the older Ordovician and Cambrian rocks (below the St. Peter sandstone), especially in the regions north and northwest of the principal producing areas of the Illinois basin. It is anticipated that a number of deep tests will be drilled in 1944.

SOUTHWESTERN INDIANA

The following statement on developments in southwestern Indiana in 1943 was furnished by Ralph E. Esarey, State geologist, and P. Hastings Keller, as-

sistant State geologist, Division of Geology, Department of Conservation, Indianapolis, Indiana.

The oil and gas development and production status in Indiana in the year 1943 is about the same as that in 1942, except for the continued decline in activity and production. There were 277 holes drilled for oil and/or gas: 99 of them were completed as oil wells, 19 as gas wells, and 159 as dry holes. This record was a decline of 21 per cent in the total number of completed tests, 20 per cent in the number of completed oil wells, and $9\frac{1}{2}$ per cent in the number of gas wells completed. As in the previous year most of the drilling (82 per cent) was in the southwest part of the state, Gibson County ranking first, with 77 completions and 20 oil wells. The remaining 18 per cent of the drilling was in the old Trenton oil and gas area which is outside of the Eastern Interior basin. The total footage drilled during the year was 482,799 feet, a decline of 18 per cent from the previous year; 146,559 feet of this was wildcat footage. The total initial production of the oil wells completed was 6,362 barrels and of the gas wells, 2,562,000 cubic feet. A few tests in the old Trenton area were drilled to the Cambrian and reported nothing more than tar residue. A Devonian test was to be made in the Griffin field in the Wabash River but due to the delay because of federal restrictions this test was not begun in 1943. It is expected to begin in 1944.

The new discoveries in 1943 were practically all in the southwest part of the State, and they were all one-well pools except one, the North Owensville pool, in Gibson County. In February, the North Owensville pool was brought in, and by the end of the year there were 9 producing wells in the pool, with a reported initial yield of 1,260 barrels per day. By the end of the year it had a daily average production of 401 barrels and an accumulated production of 39,129 barrels. The average gravity of the oil is reported to be 35.6.

Most of the development in the oil-field pools during the year took place in the Kirksville pool in Gibson County and the Caborn pool in Posey County.

The crude-oil production in 1943 was approximately 5,273,000 barrels, a decline of 20 per cent from the previous year. The Griffin field, of Gibson and Posey counties, which produced approximately 2,395,000 barrels of oil, accounted for nearly half of the total production in the state.

Although complete figures on 1943 natural gas production in Indiana are not available, the amounts produced in the three largest producing fields were as follows.

	<i>Cubic Feet</i>
Rockport field, Spencer County	500,151,000
Greensburg field, Decatur County	228,894,100
Unionville field, Monroe County	168,710,000

The total for these three fields showed a decline of 15 per cent from their 1942 production.

WESTERN KENTUCKY

The following statement regarding developments in 1943 in western Kentucky was furnished by D. J. Jones, State geologist, Lexington, Kentucky.

Oil and gas development in Kentucky west of the Cincinnati arch resulted in the drilling of approximately 465 wells for the year of 1943. A tabulation of operations shows that 5 were gas wells, 211 were oil wells, and 249 were dry holes. Formations tested ranged in age from Tertiary to Lower Ordovician. Production was found in the Pennsylvanian, Upper and Lower Mississippian.

The record is encouraging as compared with that of 1942 when 186 wells were reported from this same area. A total production of approximately 7,000,000 barrels, as compared with 4,273,616 barrels in 1942, is reflected in this increased drilling program. The easing of drilling restrictions and the newly discovered productive areas, particularly in Henderson and Union counties, have resulted in increased drilling activity. The percentage of dry holes again reflects the intolerable situation faced by the small independent operator due to the low price of oil.

Distribution of new discoveries during 1943 (Fig. 1) indicates that with more intensified drilling operations, a large number of new productive areas will be found in the Western Kentucky coal basin. Adjacent to the eastern and southeastern border of the basin shallow production has been developed in beds of Devonian and Silurian age. A more aggressive drilling campaign in this area will, no doubt, result in the discovery of new production.

Comparatively little interest has been shown in testing the Knox dolomite.

SOME PUBLICATIONS IN 1943 ABOUT GEOLOGY OF EASTERN INTERIOR BASIN

- BELL, ALFRED H., "Subsurface Structure of the Base of the Kinderhook-New Albany Shale in Central and Southern Illinois," *Illinois State Geol. Survey Rept. Inves.* 92 (1943). 13 pp., 1 pl., 3 figs.
- CARTER, CHARLES W., "Wildcat Drilling in Illinois since 1936 with Discussion of Prospects for Further Discoveries and Table of Wildcat Wells Completed in 1942," *ibid.*, *Illinois Petrol.* 47 (1943). 41 pp., 2 figs.
- EASTON, WILLIAM H., "Subsurface Structure and Oil Possibilities of Parts of Edwards, Richland and Wabash Counties, Illinois," *ibid.*, *Illinois Petrol.* 46 (1943). 12 pp., 5 figs.

DEVELOPMENTS IN MICHIGAN IN 1943¹

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ABSTRACT

During 1943 well completions in Michigan decreased 7 per cent from 1942 although the number of permits issued increased 10 per cent. Total footage drilled was 1,622,313 feet or a drop of approximately 140,000 feet. The proportion of productive wells was only 44 per cent compared with the 54 per cent of 1942. Two-thirds of the completions and three-fourths of the oil and gas wells were in the "Basin" district.

Thirteen oil fields were discovered during 1943 and 3 old fields extended. None of the discoveries was of major importance but the Goodwell and Rose Lake fields are promising. Most of the new fields produce from the Traverse (Devonian) limestone. For the first time since 1939 no field of apparent importance was found in the Dundee (Devonian) formation. Average initial production of all oil wells was 307 barrels per well compared with an initial production of 868 barrels per well in 1942. Total production for 1943 was 20,767,724 barrels, a decrease of 4 per cent, reflecting the failure to discover new important fields.

Only 47 gas wells were completed during the year, but 7 gas fields were discovered and one old field was extended. Development centered in new fields in Clare and Newaygo counties where more than half of the wells were drilled. Gas production of 19,581,420 cubic feet reached a new maximum, a 10 per cent increase over 1942.

Core-testing activity was increased during the year. Permits for 376 geological tests were issued, compared with 302 test permits issued in 1942. Geophysical exploration was carried on in the "Thumb" district and in part of the "Basin."

INTRODUCTION

This paper reviews the developments in the petroleum industry in Michigan during 1943. In 1943, 635 wells were completed, compared with 682 in 1942, and total footage drilled dropped from 1,762,201 feet in 1942 to 1,622,313 feet in 1943. Twenty oil and gas pools were discovered during the year and four old fields were extended.

OIL

The majority of the oil-well completions and discoveries were in the "Basin" district. Table I compares the distribution of wells and production in the two

TABLE I
SUMMARY OF OPERATIONS, BY DISTRICTS, IN MICHIGAN IN 1943

Area	Permits Issued	Wells Completed	Oil Wells	Initial Production Oil (Barrels)	Gas Wells	Initial Production Gas (1,000 Cu. Ft.)	Dry Holes	Total Production 1943	
								Oil (Barrels)	Gas (1,000 Cu. Ft.)
Southwestern									
Michigan	197	193	60	5,069			133	1,852,449	741,066
Basin	397	409	170	66,462	47	203,241	192	18,864,088	18,840,354
All other parts of state	33	33	3	22	—	—	30	51,187	—
Total	627	635	233	71,553	47	203,241	355	20,767,724	19,581,420

¹ Presented by title before the Association at Dallas, March 22-23, 1944. Manuscript received, April 1, 1944.

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DEVELOPMENTS IN MICHIGAN 1943

LEGEND

- OIL DISCOVERY OR EXTENSION
- ◊ GAS DISCOVERY OR EXTENSION

SCALE IN MILES



FIG. 1

TABLE II
DISCOVERY WELLS IN MICHIGAN IN 1943

County	Field	Section Transect Range	Operator	Well	Permit Number	Month and Day 1943	Total Depth (Feet)	Initial Production Oil (Barrels)	Gas (1,000 Cu. Ft.)	Formation	Remarks	Number of Wells Jan. 1, 1944
Allegan	Fillmore	11-4N-15W	J. W. Lang, Inc. & Michigan Devonian Petroleum Co.	Doseman & VanDenBeldt 1	10,993	6-10	1,542	50		Traverse		6
Clare	Cranberry Lake	2-20N-6W	Taggart Bros. Company	Millner-Keelne- Millner 1	9,947	2-4	1,308		11,600	"Mich. Stray"		21
Clare	Cranberry Lake	1-20N-6W	Leonard Drig. Co. and Rownor Corp.	Millner 1	10,145	8-20	3,840	100 (est.)		Dundee		1
Clare	Hamilton	6-10N-5W	Sun Oil Co.	Huber 1	10,000	5-2	4,137	35		Dundee		1
Gladwin	West Beaverton	19-17N-2W	Sun Oil Co.	State Beaverton A-1	10,020	3-18	3,912	20		Dundee		1
Gratiot	Ithaca	36-11N-3W	C. E. Weller & T. F. Caldwell, Inc.	Davidson 1	9,630	12-1	909		17,700	"Mich. Stray"		1
Isabella	Wise	33-16N-3W	Cities Service Oil Co.	Methner 1	10,490	12-21	3,698	303/18 hrs.		Dundee	Extension of Wise field?	1
Mecosta	Big Rapids	13-15N-10W	Mich. Consolidated Gas Co.	Hamelund 1	10,213	8-16	1,151		726	"Mich. Stray"		1
Mecosta	Fork	6-16N-7W	Mich. Consolidated Gas Co.	Compson 2	10,370	10-10	1,516		274	"Mich. Stray"		1
Missaukee	Enterprise	11-23N-5W	Sun Oil Co.	Wilson 1	10,110	9-28	4,595	32		Detroit River	"Richfield-Sylvania" pay	1
Montcalm	Douglas	28-11N-7W	Mich. Consolidated Gas Co.	Penley Chapman 1	10,186	8-27	1,198		4,200	"Mich. Stray"		1
Newaygo	Goodwell	5-14N-11W	Taggart Bros. Co.	Goodrich G-1	10,113	6-2	1,180			"Mich. Stray"		0
Newaygo	Goodwell	8-14N-11W	The Pure Oil Co.	Harris 1	9,976	7-7	2,742	419/15 hrs.	10,400	Traverse	Discovery well later deep- ened to Traverse	20
Newaygo	Woodville	29-15N-11W	Ohio Oil Co.	Vaughan, Barton & Pillsbury 1	10,152	6-23	1,158		2,500	"Mich. Stray"		5
Newaygo	Woodville	29-15N-11W	Ohio Oil Co.	Vaughan 1	9,994	5-3	3,534	175		Traverse	Dry in Detroit River and plugged back	7
Oscoda	Cedar	28-18N-9W	Ohio Oil Co.	Zimmerman 1	9,918	2-24	3,883	366/12 hrs.		Dundee		9
Oscoda	Ewart	25-18N-8W	Sun Oil Co.	Davy 1	10,112	9-5	3,749	97		Dundee	Extension of Ewart field?	1
Oscoda	Rose Lake	31-10N-9W	Union Drig. & Prod. Co. & Hunter Atha	Allen 1	9,910	7-8	3,900	386		Traverse	Dry in Detroit River and plugged back	10
Oscoda	West Ewart	29-16N-8W	Taggart Bros. Co.	Davy-Person 1	10,485	11-29	3,210			"Mich. Stray"	Extension of Ewart field?	2
Ottawa	Zeeland	36-5N-15W	Robert L. Sanders	VerHoeven & Walters 1	9,040	2-27	1,470	280/18 hrs.	1,010	Traverse	Extension of Zeeland field	7
Saginaw	Jonesfield	24-12N-1E	H. C. Nelson	Butan 1	9,853	12-18-42	3,305	5		Dundee		1
Van Buren	Bangor	14-2S-16W	Harris Oil Co.	Land Bank 1	10,223	7-25	1,238	30		Traverse		1
Van Buren	Breedsville	24-1S-16W	William H. Clock	Marr 1	9,035	2-13	1,071	70		Traverse		91
Wayne	New Boston	18-4S-9E	Vothoes Drilling Co.	Gumtow & Gibbs 1	9,873	1-29	2,653	10		Trenton		

major producing areas of the state. Oil production was 20,767,724 barrels during 1943, 986,047 barrels less than in 1942.

DISCOVERIES

None of the 13 oil discoveries or the 3 field extensions found during 1943 (Table II) appears to be of major importance. At the end of the year, 9 of the discoveries and extensions had only the discovery wells, 6 had from 6 to 10 wells, and one had 20 wells. Although at present the Dundee is the most important producing formation in the state, no field of importance was discovered in it during 1943. All but one of the Dundee discoveries were one-well pools at the end of the year. Sixty of the 67 wells completed in new fields and extensions are producing from the Traverse limestone.

In the "Basin," the Goodwell and Rose Lake fields, both producing from the Traverse, were the most active of the 1943 discoveries. At the end of 1943, the Goodwell field, Newaygo County, had 20 oil wells and 800 drilled acres, and the Rose Lake field, Osceola County, had 10 wells and 400 drilled acres. Both fields have promising undrilled locations. Eight Dundee wells and one Traverse well were drilled in the Cedar field, Osceola County.

Breedsville, Van Buren County and Fillmore, Allegan County, were the most active of the new fields in southwestern Michigan. Nine oil wells were completed in the Breedsville field and 6 wells in the Fillmore field. Both fields produce from the Traverse limestone.

Although production from the Detroit River and Sylvania formations was established in 6 different areas during 1942, little activity was reported for these areas during 1943. The only discovery in the Detroit River formation was in the Enterprise field, Missaukee County. Production was found approximately 1,000 feet below the top of the Detroit River formation in a pay zone that is correlative with the "pays" in the Richfield, South Adams, East Norwich, Winterfield, and Rose City fields.

FIELD DEVELOPMENT

Development in previously discovered fields in the "Basin" centered in the Fork, Kawkawlin, Evart and Prosper fields. The Fork field, Mecosta County, discovered in 1942, was increased to 1,440 acres by drilling 31 wells during 1943. Thirty-one wells, mainly inside locations, were drilled in the Kawkawlin field, Bay County, discovered in 1938. The area of the Evart field, Oseola County, a 1942 discovery, was increased to 1,100 acres by 15 new wells. Twelve wells were drilled in the Prosper field, Missaukee County, discovered in 1942, increasing its area to 520 acres.

In Southwestern Michigan, North Bangor, Van Buren County, and Zeeland, Ottawa County, were the most active of the old fields. Due in part to revision of spacing regulations, seventeen wells were drilled in the North Bangor field, a 1942

TABLE III
MICHIGAN OIL FIELDS†
(January 1, 1944)

Field	County	Year of Discovery	Producing Formation	Depth to Pay (Feet)	API Gravity of Oil	Drilled Acreage	Recovery per Drilled Acre (Barrels)	Production in 1943 (Barrels)	Accumulative Production (Barrels)
Adams	Arenac	1937	Traverse	2,025	37.0				
			Dundee	2,030	34.0	610	5,845	984,440	3,565,334
Akron	Tuscola	1938	Det. River	3,425	41.9	†	†	33,265	162,085
Bangor	Van Buren	1939	Traverse	1,000	29.5	240	1,917	85,515	460,215
Beaverton	Gladwin	1934	Dundee	3,880	41.3	230	2,910	17,935	669,330
Bentley	Gladwin	1937	Dundee	3,510	42.1	640	1,282	90,717	820,254
Birch Run	Saginaw	1934	Berea	1,530	43.3	260	706	7,326	206,410
Bloomingsdale	Van Buren	1938	Traverse	1,220	42.0	1,380	4,250	166,518	5,865,477
Breedsville	Van Buren	1943	Traverse	1,075	33.9	90	662	59,581	59,581
Cedar	Oscola	1943	Traverse	3,325					
			Dundee	3,810	48.1	360	442	150,274	150,274
Clare City	Clare	1938	"Mich." Stray	1,320	30.2	—	—	4,118	25,394
Clayton	Arenac	1936	Dundee	2,550	34.2	600	6,302	182,633	3,835,123
Columbia	Van Buren	1938	Traverse	1,185	39.0	1,100	1,844	65,199	2,028,832
Cranberry Lake	Clare	1943	Dundee	3,835				4,992	4,992
Crystal	Montcalm	1935	Dundee	3,190	43.5	1,820	3,087	48,905	7,256,468
Currie	Isabella	1936	Dundee	3,020	45.9	—	—	4,068	158,287
Dalton	Muskegon	1940	Traverse	1,850	—	—	—	676	2,860
Deerfield	Monroe	1920	Trenton	2,115	42.7	155	2,209	50,250	356,200
Diamond Springs	Allegan	1938	Traverse	1,465	41.0	410	1,018	33,519	786,264
Dorr	Allegan	1938	Traverse	1,605	41.0				
			Salina?	3,035	22.0	260	1,135	14,255	205,073
East Norwich	Missaukee	1942	Dundee	3,085				25,017	28,219
			Detroit River	4,390					
Edenville	Midland	1938	Dundee	3,790	41.0	350	3,354	34,883	1,173,766
Edmore	Montcalm	1943	Traverse	3,105	43.2	90	4,902	8,602	441,221
Enterprise	Missaukee	1943	Detroit River	4,430				2,100	2,100
Ewart	Oscola	1942	Dundee	3,755	47.8	1,100	1,118	1,031,310	1,220,502
Fillmore	Allegan	1943	Traverse	1,530	41.1			11,641	11,641
Fork	Mecosta	1942	Dundee	3,835	50.1	1,440	596	804,785	857,717
Goodwell	Newaygo	1943	Traverse	2,785		800	355	283,886	283,886
Groat	Gladwin	1940	Dundee	3,825				4,092	22,013
Hamilton	Clare	1940	Dundee	4,078				2,779	13,123
Hatton	Clare	1941	Dundee	3,945				41,668	48,430
Headquarters	Roscommon & Clare	1941	Traverse	3,380	42.3				
			Detroit River	4,955	48.9	1,440	3,218	1,998,526	4,634,178
Holland	Ottawa	1940	Traverse	1,516	38.4			1,722	14,689
Hope	Barry	1939	Traverse	1,835	39.9			2,454	7,522
Hopkins	Allegan	1939	Traverse	1,635	41.5	75 est.	1,595	4,903	110,618
Jonesfield	Saginaw	1943	Dundee	3,280				63	63
			Berea	1,505	38.0				
Kawkawlin	Bay	1938	Dundee	2,830	35.0	1,840	765	689,314	1,407,925
			Salina	7,168	55.3			921	6,567
Lakefield	Saginaw	1937	Dundee	3,185	39.0				
Leaton	Isabella	1940	Dundee	3,655	43.0	880	3,522	101,520	3,099,337
Marne	Ottawa	1940	"Berea"	1,165				720	4,551
Mill Lake	Van Buren	1938	Traverse	1,200	40.0	340 est.	1,343	23,528	456,443
Monterey	Allegan	1938	Traverse	1,645	37.6	280	1,417	19,384	396,555
Mount Haley	Midland	1934	Dundee	3,477	39.6			1,021	32,330
Mt. Pleasant	Isabella								
	& Midland								
Muskegon	Muskegon	1928	Dundee	3,545	41.8	4,180	5,308	301,880	22,187,955
		1927	Traverse	1,700	37.4	2,800 est.	2,407	25,208	6,730,064
			Dundee	2,025	32.0			928	928
Muskrat Lake	Van Buren	1941	Traverse	1,285	39.2	580	446	45,029	258,671
New Boston	Wayne	1943	Trenton	2,635				928	928
New Salem	Allegan	1938	Traverse	1,625	41.0	970	3,631	222,687	3,522,105
North Bangor	Van Buren	1942	Traverse	1,010	32.6	230	661	145,540	152,056
North Buckeye	Gladwin	1937	Dundee	3,615	39.0	2,710	5,554	352,090	15,052,816
Otisville	Genesee	1941	Traverse	1,894	44.3			875	3,958
Otsego	Allegan	1939	Traverse	1,465				1,987	2,121
Overisel	Allegan	1938	Traverse	1,490	42.1	1,550	1,403	127,302	2,175,412
Pine	Montcalm	1938	Traverse	2,836	45.0			5,423	38,571
Pine River	Gratiot	1942	Dundee	3,280				4,281	7,230
Porter	Midland	1933	Dundee	3,415	40.6	4,330	7,692	741,631	33,307,015
Porter	Van Buren	1939	Traverse	1,140	37.5			848	3,721
Prosper	Missaukee	1942	Dundee	3,835	43.2	520	768	306,939	399,415
	Oscola		Traverse	2,925					
Reed City	Lake	1940	Dundee	3,490		5,230	3,768	7,847,195	19,705,485
			Detroit River	3,585	46.3				
Richfield	Roscommon	1941	Detroit River	4,185	43.4	480	311	77,314	140,247
Riverside	Missaukee	1942	Dundee	3,944	44.5			10,340	22,773
Rose City	Ogemaw	1942	Detroit River	4,135	41.2			4,076	4,494

TABLE III—Continued

Field	County	Year of Discovery	Producing Formation	Depth to Pay (Feet)	API† Gravity of Oil	Drilled Acreage	Recovery per Drilled Acre (Barrels)	Production in 1943 (Barrels)	Accumulative Production (Barrels)
Rose Lake	Oscola	1943	Traverse	3,120	45.4	400	224	80,677	80,677
Saginaw	Saginaw	1945	Berea	1,825	46.1	1,500	est. 043	20,103	1,414,616
Salem	Allegan	1937	Traverse	1,570	38.3	2,100	1,451	106,020	3,048,330
Sauble Lake	1942	Traverse	2,145	35.6	200	245	22,406	49,092	
Sherman	Isabella	1936	Dundee	3,650	42.0	870	4,798	116,686	4,175,051
Skeels	Clare	1942	Detroit River	4,844				1,485	1,485
South Akron	Tuscola	1941	Dundee	2,850	37.3			3,603	9,546
South Beaverton	Gladwin	1936	Dundee	3,845	41.1	340	1,351	105,779	439,538
South Buckeye	Gladwin	1936	Dundee	3,570	39.0	1,920	2,021	80,595	3,881,104
South Tallmadge	Ottawa	1939	Traverse	1,820	38.6	570	632	62,601	360,516
Temple	Clare	1938	Dundee	3,885	44.3	2,500	5,417	516,225	13,543,553
Trowbridge	Allegan	1937	Traverse	1,355	41.2	520	326	30,674	169,666
Vernon	Isabella	1930	Dundee	3,755	44.1	790	5,645	74,793	4,459,242
Walker	Kent & Ottawa	1938	Traverse	1,850	40.0	4,825	1,962	452,761	9,464,839
West Beaverton	Gladwin	1943	Dundee	3,876					
West Branch	Ogemaw	1933	Dundee	2,650	36.8	2,670	1,942	206,575	5,186,331
West Hopkins	Allegan	1941	Traverse	1,580		310	1,144	44,954	354,795
Winfield	Montcalm	1936	Dundee	3,340	43.2			3,892	51,360
Winterfield	Clare	1940	Traverse	3,105					
			Dundee	3,770	44.2				
			Detroit River	5,015		960	3,179	683,273	3,051,941
Wise	Isabella	1938	Dundee	3,705	45.2	1,100	1,732	176,475	1,905,558
Woodville	Newaygo	1943	Traverse	2,280		280	246	68,006	68,006
Wyoming Park	Kent	1939	Traverse	1,880	39.0			9,722	111,952
Yost	Midland	1932	Dundee	3,420	40.6	2,010	3,546	277,608	7,127,934
Zeeland	Ottawa	1942	Traverse	1,495	41.9	600	199	83,600	127,889

Total oil production in 1943: 20,767,724 barrels
 Accumulative oil production: 204,114,781 barrels

† Fields which are abandoned or have produced less than 500 barrels during 1943, except 1943 discoveries, are not included.

‡ Drilled acreage and recovery per acre not calculated for fields in which wells are too few or scattered to be significant.

discovery. The Zeeland field, discovered in 1942, was extended westward by eight new wells.

NATURAL GAS

Gas well completions during 1943 dropped to 47 from the 74 completions reported in 1942. More than half of the wells were drilled in Clare and Newaygo counties. Gas production for the year reached a new high of 19,581,420,000 cubic feet, a 10 per cent increase over 1942.

DISCOVERIES

Seven gas fields were discovered and one old field extended in 1943 (Table II) but only two of the discoveries were developed.

Twenty-one wells were completed in the Cranberry Lake field, Clare and Missaukee counties, and 3,360 acres proved. At the end of the year, 5 wells had been drilled in the Woodville field, Newaygo County.

EXPLORATION

The shallow-hole core-testing campaign for locating structure was 25 per cent more active in 1943 than in 1942. Permits for 376 geological tests were issued, nearly all located in the north half of the southern Peninsula. Although study

TABLE IV
MICHIGAN GAS FIELDS
(January 1, 1944)

Field	County	Year of Discovery	Producing Formation	Depth to Pay (Feet)	Drilled Acreage	Recovery per Drilled Acre (M. Cu. Ft.)	Production in 1943 (M. Cu. Ft.)	Accumulative Production (M. Cu. Ft.)
Albion	Calhoun	1941	Traverse	1,600	320	10	6,114	6,114
Austin	Mecosta	1933	"Mich. Stray"	1,385	1,200	4,782	—	5,738,633
Big Rapids	Mecosta	1943	"Mich. Stray"	1,141	160	—	—	—
*Broomfield	Isabella	1920	"Mich. Stray"	1,350	4,440	2,009	1,006,860	8,917,827
Clare City	Clare	1938	"Mich. Stray"	1,290	720	1,766	125,282	1,271,200
Clayton	Arenac	1936	Berea	1,186	1,440	2,714	572,070	3,908,264
Coopersville	Ottawa	1939	"Berea"†	1,235	640	170	23,401	108,839
Cranberry Lake	Clare	1943	"Mich. Stray"	1,200	3,360	—	2,613	2,613
†Crystal	Montcalm	1935	"Mich. Stray"	1,000	320	1,729	68,944	553,197
Deep River	Arenac	1936	Berea	1,490	1,040	535	295,717	555,923
*Deerfield	Isabella	1941	"Mich. Stray"	—	—	—	—	—
Douglass	Montcalm	1943	"Mich. Stray"	1,100	160	—	—	—
Edmore	Montcalm	1936	"Mich. Stray"	1,300	4,400	1,071	1,080,230	4,714,160
Evert	Oscola	1941	"Mich. Stray"	1,415	2,560	117	270,108	290,068
Fork	Mecosta	1942	"Mich. Stray"	1,485	480	45	21,402	21,402
Freeman	Clare	1939	"Mich. Stray"	1,475	2,040	938	381,632	1,013,517
Fremont	Isabella	1941	"Mich. Stray"	1,235	640	235	125,783	150,509
Goodwell	Newaygo	1943	"Mich. Stray"	1,170	—	—	—	—
Ithaca	Gratiot	1943	"Mich. Stray"	800	160	—	—	—
Lincoln	Clare	1938	"Mich. Stray"	1,530	2,400	1,511	1,172,456	3,626,304
McKay	Clare	1930	"Mich. Stray"	1,400	360	1,979	—	712,626
Marion	Clare & Osceola	1940	"Mich. Stray"	1,370	9,760	641	3,009,694	6,254,038
Muskegon	Muskegon	1927	Traverse	1,640	1,200 est.	5,875	80,030	7,049,561
North Star	Gratiot	1940	Detroit River	870	160	583	27,491	93,300
Ravenna	Muskegon	1936	"Mich. Stray"	1,205	4,160	344	157,462	1,432,593
Reed City	Osceola & Lake	1940	"Mich. Stray"	1,220	4,480	1,134	1,917,273	5,080,850
Richland	Montcalm	1940	"Mich. Stray"	1,205	800	370	108,412	296,026
Riverside	Missaukee	1940	"Mich. Stray"	1,435	2,720	345	816,966	938,999
Salem	Allegan	1941	Salina	2,725	160	431	18,242	68,877
Shaver	Gratiot	1935	"Mich. Stray"	1,020	2,600	2,298	1,469,651	5,973,207
Sheridan	Mecosta	1935	"Mich. Stray"	975	320	724	31,957	231,814
Six Lakes	Montcalm & Mecosta	1934	"Mich. Stray"	1,270	9,520	3,732	4,896,729	35,525,631
South Tallmadge	Ottawa	1940	"Berea"	1,030	200	1,181	136,736	236,192
Sylvan	Osceola	1941	"Mich. Stray"	1,525	320	126	40,439	40,439
Vernon	Isabella	1930	"Mich. Stray"	1,300	760	1,880	12,768	1,429,059
Walker	Kent	1939	"Berea"	1,150	—	—	113,087	341,814
West Evert	Osceola	1943	Detroit River	2,250	320	—	—	—
Winfield	Montcalm	1935	"Mich. Stray"	1,470	—	—	—	—
Wise	Isabella	1940	"Mich. Stray"	1,125	3,040	855	622,215	2,600,858
Woodville	Newaygo	1943	"Mich. Stray"	1,250	800	905	157,222	723,970
				1,185	800	—	—	—

Total dry and casinghead gas production in 1943: 19,581,420,000 cubic feet
Accumulative dry and casinghead gas production: 118,712,569,000 cubic feet

* Deerfield appears to be an extension of Broomfield. Data from Deerfield are included in Broomfield.

† Includes gas wells in Ferris and Crystal townships.

‡ A sandy dolomite in the western part of the state at the horizon of the Berea sandstone.

of subsurface geology and stratigraphy by sample work, aided by core-test information, continued to be the most effective method of discovery in Michigan, considerable seismograph work was done in the "Thumb" district and adjoining parts of the "Basin."

DEVELOPMENTS IN NORTH MID-CONTINENT IN 1943¹

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ABSTRACT

Kansas established another production record in 1943 with a total production of 108,441,648 barrels, over 9,500,000 barrels more than the previous year. The peak daily average production was 319,272 barrels in March, but by December had fallen to 278,229 barrels per day, or the lowest daily average by months of the year. Most Kansas fields are now producing as much oil as should be taken from them according to good production practice.

The Kansas exploration program was more fruitful in 1943 than in several recent years, both because of the discovery of pools in non-productive counties and also because some of the new pools developed into areas of more than average productivity. Although 19 of the 57 discoveries may be classified as extensions, many of the other pool-openers are outside the limits of the intensively drilled portion of the Central Kansas uplift. The discovery of the Carmi and Chitwood pools and extension of the Iuka pool sustained interest in Pratt County. It also encouraged development in Barber County on the south where several pools of questionable merit were being developed at the end of the year. The Carmi pool was the most important development of the year in the state.

Several townships around the common corners of Rooks, Ellis, Graham, and Trego counties were active in 1944 as the result of the discovery, in 1943, of the Palco, Marcotte, and Kriley pools of Rooks County, and the extension of the Ellis, Morel, and Berry pools. Early in 1944 the Ellis Northwest pool was found in Trego County, and the Hobart and Zurich Townsite pools in Rooks County. If these pools are as large and as prolific as similar Arbuckle dolomite pools on the Central Kansas uplift, important reserves have been found.

Commercial oil pools were found for the first time in Saline and Dickinson counties in which exploration has gone on intermittently for 25 years. A small pool in T. 8, R. 26 W., was the first pool to be found in Sheridan County. It encouraged development in northwestern Kansas. Several small fields were found in Stafford County. There were the customary number of extensions in Russell, Barton, and Rice counties. A "Mississippi lime" discovery started a lease play in Ness and adjacent counties. "Outside capital" was more willing than established oil companies to assume the risks of wildcatting in 1943. This explains in part the increase in wildcat completions from 333 to 436, and the fact that 38 per cent of all wildcats were drilled without geologic background. Most of the important discoveries of the year can be attributed to the core drill. Subsurface geology is responsible for the largest number of new pools and extensions. Seismic work assisted in the discovery of more pools than heretofore, but they are of minor importance.

As in other states, development of Kansas pools is hampered by war-time restrictions, governmental red tape, shortage of materials and manpower. The dry-hole percentage increased from 40 per cent to 48 per cent due, in part, to the 40-acre spacing ruling. Potential production per well suffered another decline, being 900 barrels per day compared with 1,106 barrels in 1942.

There were no important developments in Missouri or Iowa. Twenty-nine dry wildcats were completed in Nebraska, mostly on geophysical information. Inside developments of Nebraska pools had nearly ceased by the end of 1943.

KANSAS

DRILLING ACTIVITY

Kansas experienced an increase of drilling activity in 1943 compared with the previous year as shown in Table I.

TABLE I

	1943	Percentage	1942	Percentage	1941	Percentage
Oil wells	796	50	713	52.7	1,253	68.9
Gas wells	30	1.9	89	6.6	75	4.2
Dry holes	769	48.1	551	40.7	490	26.9
	1,595		1,353		1,818	

¹ Presented by title before the Association at Dallas, March 22-23, 1944. Manuscript received April 20, 1944.

² Darby Petroleum Corporation, 802 Petroleum Building.

The figures for 1943 do not include recompleted wells. In this classification there were 43 oil wells with a potential of 26,324 barrels, 3 gas wells with a capacity of 3,574,000 cubic feet, and 47 dry holes.

The increase in the dry-hole percentage from 40 per cent to 48 per cent, is due to several factors, namely, the 40-acre spacing ruling, a slight increase in exploratory wells, and the willingness of new companies to drill wildcat tests and wells on marginal leases, which would not have been drilled by established companies. Individual operators and outside companies in the higher income-tax brackets were more willing than established oil companies to assume the risks on third and fourth rate deals. They contributed, in some cases, much valuable geological information, but accomplished very little in developing any important oil reserves. The decline in the production of new well completions, which began in 1941, continued through 1943, as shown in Table II. This decline is due to the fact that many Kansas completions are inside wells, but also to a great extent to the fact that operators are less anxious to establish inflated potentials than in previous years.

TABLE II

<i>Year</i>	<i>Oil Wells</i>	<i>Barrels Potential</i>	<i>Barrels Average Potential</i>	<i>Gas Wells</i>	<i>Capacity in 1,000 Cubic Feet</i>	<i>Average Capacity in 1,000 Cubic Feet</i>
1939	983	1,548,772	1,577	62	1,280,984,000	20,661,000
1940	1,421	2,218,720	1,561	61	1,292,201,000	21,183,000
1941	1,253	1,727,593	1,379	75	797,011,000	10,626,000
1942	713	788,139	1,106	89	610,769,000	6,862,572
1943	796	716,777	900	30	320,420,000	10,680,667

LEASING ACTIVITY

Early in the year leasing activity continued strong in the Salina basin as the result of the development of several pools in McPherson, Marion, and Saline counties. The discovery of the Studley pool in T. 8 S., R. 26 W., was the first production in Sheridan County, and resulted in a great lease play through Sheridan, Decatur, Rawlins, Thomas, and Gove counties; likewise, developments later in the year in southwestern Rooks and northwestern Ellis counties increased lease activity in that area and in Graham and Trego counties. Ness, Hodgeman, and Lane counties also were active as the result of the discovery of the Arnold field in T. 16 S., R. 25 W. One of the most active lease plays to develop in Kansas in several years occurred in Pratt and Barber counties as the result of discoveries in that area. In general, it may be said that leasing was based on less definite geological information in 1943 than for several years previous.

PRODUCTION

Kansas produced 108,441,648 barrels of oil in 1943, an increase of more than 9,500,000, barrels over the yield in 1942, at that time the highest production. In March the daily average production was 319,272 barrels, the highest daily rate on a monthly basis. By December production had fallen to 278,229 barrels per day, the lowest daily average of the year. Kansas allowable was set at 275,000

for the first few months of 1944 and this figure is believed to represent approximately the maximum rate of withdrawal according to good production practice. Several fields could produce without waste at a higher rate than is now allowed, but it is doubtful if this situation could continue for many months.

The average daily allowable in barrels per prorated well during the past three years fluctuated as shown in Table III.

TABLE III

	1941	1942	1943		1941	1942	1943
January	22.4	27.7	37.1	July	26.8	31.7	35.4
February	22.1	26.6	36.8	August	28.1	30.8	33.4
March	22.8	26.1	38.4	September	27.7	32.5	34.2
April	24.0	26.7	36.3	October	28.7	33.6	32.2
May	24.9	26.2	34.6	November	28.2	34.4	32.1
June	26.5	29.6	34.6	December	28.6	35.2	32.4

WILDCATTING

A summary of Kansas wildcat activity is given in Table IV.

TABLE IV
WILDCAT WELLS

	No.	Footage	Chance	Sub-surface	Seismo-graph	Core Drill	Surface	Core Drill and Subsurf.	Core Drill and Seismo-graph	Surface and Sub-surf.	Seismo-graph and Surface	Gravity Meter
Discovery oil wells	37	132,681	3	12	11	8	3	0	0	0	0	0
Discovery gas wells	1	1,266	0	0	0	0	1	0	0	0	0	0
Dry holes	280	1,078,916	121	46	50	32	11	9	5	2	2	2
Total	318	1,212,863	124	58	61	40	15	9	5	2	2	2

OUTPOST WELLS

Extension oil wells	19	65,585	2	15	1	1	0	0	0	0	0	0
Dry out-post wells	99	337,680	40	35	7	10	2	2	2	1	0	0
Total	118	403,274	42	50	8	11	2	2	2	1	0	0
Grand Total	436	1,616,137	166	108	69	51	17	11	7	3	2	2

Although proved reserves discovered in Kansas in 1943 were only about half the amount of production, the year was a successful one in terms of exploration, due to the prolific character of some of the fields and the outlying locations of others. There was the customary number of new small pools and extensions on the intensively drilled part of the Central Kansas uplift, and more encouraging results followed in counties which had heretofore failed to produce. As usual, sub-surface methods accounted for the largest number of pools and the greatest reserve. The number of new pools found by seismic methods was better than normal, but most of these are of limited areal extent or productive capacity. Most of the important discoveries of the year can be attributed to the core drill. None of the five pools found by random drilling is now important.

Thirty-eight per cent of all exploratory tests were drilled without benefit of

scientific advice. This high figure is explained in part by the introduction of new capital in the exploration program. Concerns from several other industries spent large portions of their war profits in wildcatting in Kansas, and have very little to show for their ill-advised splurges. Also, many third- and fourth-rate farm-outs were drilled by "outside capital" with poor results.

There was a slight increase in wildcat activity by major companies in 1943 and this tendency is continuing on into the present year.

Table V shows a comparison of wildcatting from 1938 to 1943.

TABLE V

Year	Oil and Gas Wells	Total Feet	Dry Holes	Total Feet	Total Wells	Total Feet
1938	43	148,050	129	478,389	172	626,439
1939	21	67,259	74	258,031	95	325,290
1940	23	75,142	122	408,887	145	484,020
1941	37	140,284	200	688,180	237	828,473
1942	34	122,041	299	1,039,753	333	1,161,794
1943	57	199,532	379	1,416,605	436	1,616,137

The average discovery well in 1943 had a depth of 3,500 feet compared with 3,589 feet in 1942. The average dry hole in 1943 was drilled 3,737 feet compared with 3,477 feet in 1942. The deepest wildcat was drilled to 7,082 feet; only fourteen reached below 5,000 feet.

NEW POOLS

Table VI lists the new pools discovered in western and northeastern Kansas in 1943 as named by the nomenclature committee of the Kansas Geological Society. Eight of the 57 discoveries have been joined with old pools. Thirty pools had only one well at the end of the year. The more important areas are discussed.

Pratt County.—The Chitwood pool lies in T. 28 S., R. 12 W., on the Cunningham trend and was discovered by the Lion Oil Refining Company in September. Prolific production was found in the Simpson sand and recent developments in the area indicate a reserve of better than average size is being developed. This discovery, which is based on core-drill work, has encouraged exploration for other Simpson pools in this part of the state in which heretofore little rich Simpson production has been found.

The Carmi pool, T. 26 S., R. 12 W., was extended west and joined to the Iuka North pool, a 1943 discovery in the Arbuckle. At the end of the year, about 70 wells had been completed in the pool. Most of these received the maximum 3,000 barrel potential allowed by the Corporation Commission. The Carmi pool is the best new pool found in south-central Kansas since the discovery of the Peace Creek-Zenith trend. The Iuka pool, where oil is produced from Simpson sand and dolomite, on the southwest flank of the Carmi structure, was enlarged during the year, but the wells are less prolific.

Barber County.—Successful developments in Pratt County encouraged exploration on the south in Barber County and the discovery of the Turkey Creek pool, T. 30 S., R. 15 W., and the revival of the Skinner pool, T. 31 S., R. 14 W.

TABLE VI
WESTERN KANSAS POOLS, 1943

Pool	County	Sec.-T.-R.	Total Depth (Feet)	Producing Formation	Method of Exploration	Potential (Barrels)
Ainsworth, SE.	Barton	10-17-13W	3,366	Arbuckle	Chance	250
Ames	Barton	27-18-11W	3,329	Lans.-K.C.	Subsurface	287
Arnold	Ness	22-16-25W	4,562	"Miss. lime"	Core drill	142
Bahr	Barton	26-18-15W	3,506	Basal sand	Subsurface	50
Barrett	Barton	36-16-14W	3,465	Arbuckle	Subsurface	266
Beeching	Ellis	34-15-16W	3,328	Lans.-K.C.	Subsurface	806
Brack, N.	Stafford	6-22-12W	3,660	Arbuckle	Seismograph	80
Burrtown, NE.	Harvey	9-23-3W	3,315	"Miss. lime"	Subsurface	200 est.
Byron	Stafford	4-21-12W	3,475	Arbuckle	Subsurface	388
Chitwood	Pratt	23-28-12W	4,490	Simpson	Core drill	2,672
Click	Rice	3-18-7W	3,187	Misener sand	Subsurface	25
Dayton, N.	Phillips	13-2-10W	3,737	Lans.-K.C.	Core drill	75
Eveleigh	Barton	11-18-14W	3,332	Sooy Cong.	Seismograph	425
Farmington	Stafford	33-24-15W	4,433	Arbuckle and Misener	Seismograph	3,000
Forest Hills, S.	Russell	33-15-12W	3,276	Arbuckle	Subsurface	150
Frisbie	Stafford	5-26-13W	4,455	Lans.-K.C.	Seismograph	3,000
Gates, S.	Stafford	3-22-13W	3,752	Arbuckle	Subsurface	25
Glatthart	Ellis	16-12-10W	3,560	Lans.-K.C.	Subsurface	25
Greenvale, W.	Russell	31-14-12W	3,176	Arbuckle	Subsurface	279
Grunder	Stafford	11-25-15W	4,500	Lans.-K.C.	Seismograph	25
Gustason, NW.	Russell	15-15-12W	3,027	Arbuckle and Lans.-K.C.	Subsurface	203
Hansen	Phillips	14-5-26W	3,799	Arbuckle and Lans.-K.C.	Seismograph	1,626
Heyen	Stafford	24-22-12W	3,654	Arbuckle	Subsurface	25
Hilger, N.	Reno	34-25-4W	4,102	Viola	Subsurface	2,595
Hunter	Saline	20-16-1W	2,681	"Miss. lime"	Core drill	1,500
Iuka, N.	Pratt	25-26-13W	4,341	Arbuckle	Core drill	1,620
James	Stafford	18-21-12W	3,563	Arbuckle	Chance	368
Keller	Rice	3-19-6W	3,244	Sooy conglom.	Subsurface	249
Kriley	Rooks	22-8-18W	3,374	Arbuckle	Core drill	25
Krug	Russell	8-14-14W	3,085	Lans.-K.C.	Chance	150
Leiker	Ellis	14-15-18W	3,622	Arbuckle and Lans.-K.C.	Seismograph	112
Marcotte	Rooks	15-10-20W	3,764	Arbuckle	Surface	2,711
Millard	Barton	29-16-14W	3,480	Arguckle	Subsurface	15
Morel, SE.	Graham	25-9-21W	3,766	Arbuckle	Subsurface	1,004
Paden	McPherson	10-18-1W	2,770	"Miss. lime"	Subsurface	548
Palco	Rooks	5-10-20W	3,846	Arbuckle	Core drill	3,000
Pliny	Saline	9-16-1W	1,998	Lans.-K.C.	Chance	86
Prosper	Rice	5-18-6W	3,244	Arbuckle	Subsurface	78
Riverview	Ellis	19-11-18W	3,610	Arbuckle	Seismograph	1,342
Roesler	Barton	14-18-11W	3,306	Arbuckle	Subsurface	151
Rothgarn	Stafford	10-21-13W	3,000	Arbuckle	Seismograph	180
Roxbury, SE.	McPherson	20-17-1W	2,674	"Miss. lime"	Subsurface	25
Salina	Saline	30-14-2W	3,234	Viola	Subsurface	124
Silica, NW.	Barton	27-19-11W	3,361	Arbuckle	Subsurface	26
Spangenberg	Stafford	21-22-12W	3,697	Arbuckle	Seismograph	868
Stark, N.	Pratt	12-26-12W	4,145	Viola	Subsurface	1,031
Strecker	Russell	21-15-14W	3,350	Arbuckle	Subsurface	73
Studley	Sheridan	23-8-26W	4,444	Lans.-K.C.	Surface	1,378
Syms	Stafford	20-21-12W	3,594	Arbuckle	Seismograph	100
Turkey Creek	Barber	20-30-15W	4,456	Pennsylvanian sand	Surface	129
Van Lieu	Stafford	20-24-13W	4,080	Arbuckle	Seismograph	1,612
Volkland	Rice	27-18-9W	3,251	Arbuckle	Core drill	104
Williamson, SE.	Russell	10-14-14W	3,267	Basal sand	Subsurface	108
Zenith, W.	Stafford	8-24-11W	3,863	Viola	Subsurface	270

NORTHEASTERN KANSAS POOLS

Bonnacord	Dickinson	30-14-1E	2,518	Burgess sand	Chance	223
Fanska	Marion	6-17-1E	2,683	"Miss. lime"	Core drill	91
Jarbalo	Leavenworth	8-10-21E	1,266	McLouth sand	Surface	10,000,000 gas

Additional development was under way at turn of the year with somewhat promising results.

Sheridan County.—The Union Oil Company, in its first venture in Kansas, discovered the Studley pool, T. 8 S., R. 26 W., on surface structure. The producing zones are in the Lansing-Kansas City limestone topped at 3,679 feet. Four moderately small wells and 3 dry holes were completed by the end of the year. Although apparently no large reserve has been found here, the discovery is the

first in the county and is 12 miles west of the nearest producing area in Graham County. It stimulated interest in all of northwest Kansas.

Dickinson County.—After 25 years of intermittent exploration, the first oil produced in Dickinson County was found in 1943 when the Lost Springs pool in Marion County was extended across the line and a small well was discovered in T. 14 S., R. 1 E. It is the Bonnacord pool. The discovery well made 223 barrels per day from the Burgess sand at 2,483–2,490 feet.

Ness County.—A small well in the Mississippian limestone was the discovery of the Arnold pool, T. 16 S., R. 25 W. Core drilling was the basis of the location. The value of the pool remains in doubt, but it started a lease play in Ness and Hodgeman counties.

Ellis and Rooks counties.—The discovery of several pools west of the Bemis and Burnett fields of Ellis County appear to be the forerunner of important additional reserves around the common corners of Ellis, Rooks, Trego, and Graham counties. After much core-drill work, the Continental Oil Company discovered the Palco pool, Sec. 5, T. 10 S., R. 20 W., and the Kriley pool, Sec. 22, T. 8 S., R. 18 W. The Champlin Refining Company discovered the Marcotte pool, Sec. 15, T. 10 S., R. 20 W. The Ellis and Berry pools, both discovered in 1942, and the Morel pool were extended in 1943. Early in 1944, the Ellis Northwest pool was found in Trego County, and the Hobart and Zurich Townsite pools in Rooks County. Although development has not progressed far in any of these new pools, results justify the belief that important reserves in both Arbuckle dolomite and Lansing-Kansas City limestone have been uncovered.

The Hunter, Paden, Roxbury Southeast, and Fanska pools are Mississippian limestone producing areas found on the south fringe of the Salina basin. Several extensions and relatively small discoveries in Arbuckle dolomite were made in Stafford County.

MISSOURI AND IOWA

Two wildcat tests were completed in Iowa, totalling 3,799 feet. They were Hayes *et al.* Fry No. 1, Sec. 23, T. 71 N., R. 9 W., Jefferson County, which was abandoned at 965 feet, and F. O. Aiken's Paul No. 1, Sec. 15, T. 73 N., R. 40 W., Mills County, which was a dry hole at 2,834 feet.

The Forest City basin play in northwest Missouri has practically ceased. Seven dry wildcats were completed in the state during the year, with a total footage of 12,546 feet. These offered little encouragement for pre-Pennsylvanian production in the area. The south offset of the discovery well in the Tarkio pool, discovered by the Cities Service Oil Company, Sec. 32, T. 65 N., R. 35 W., Atchison County, was completed as a 20-barrel well from a sand in the Cherokee shale, at 1,398 feet.

NEBRASKA

For the second successive year wildcat drilling in Nebraska was unsuccessful. Twenty-nine dry holes were completed: 20 in the western ranges, and 9 in eastern

ranges. The total footage was 84,865 feet. Complete information is not available on many stratigraphic tests and tight holes. The geological background of these tests is: seismograph, 14; core drill, 2; soil analysis and magnetometer, 2; core drill and seismograph, 1; chance, 3; unknown, 7.

Table VII gives a summary of Nebraska wildcats in 1943. Most Nebraska

TABLE VII
1943 WESTERN NEBRASKA WILDCATS

County	Sec.-T.-R.	Operator and Farm	Total Depth (Feet)	Formation	Method
Harlan	10-1N-10W	Bell's Roulier	4,040	Arbuckle	Seismograph
Furnas	31-1N-24W	Helmerich & Payne's Hamilton	3,478	Pre-Cambrian	Seismograph
Harlan	14-2N-18W	Bell's Battin	3,557	Arbuckle	Seismograph
Harlan	20-2N-18W	Ohio's Hanes	3,936	Arbuckle	Seismograph
Harlan	25-2N-20W	Bell's Flammang	3,840	Arbuckle	Seismograph
Furnas	33-2N-21W	Trickett & Adkins' Gossic	3,723	Pre-Cambrian	Chance
Furnas	31-3N-25W	Stanolind's Harding	3,422	Pre-Cambrian	•
Chase	27-5N-38W	Stanolind's Strat. test 1	•	•	•
Phelps	15-7N-20W	Carter's Strat. test 10	3,880	Pre-Cambrian	Seismograph
Buffalo	9-8N-18W	Carter's Strat. test 11	3,835	Pre-Cambrian	Seismograph
Buffalo	27-9N-13W	Carter's Strat. test 9	3,917	Arbuckle	Seismograph
Buffalo	35-10N-16W	Bell's Burton	4,070	Arbuckle	Seismograph
Buffalo	27-10N-18W	Bell's Nickel	3,810	Arbuckle	Seismograph
Perkins	9-10N-36W	Carter's Strat. test 8	4,869	Pre-Cambrian	Seismograph
Buffalo	26-12N-17W	Bell's Swenson	3,778	Arbuckle	Seismograph
Buffalo	3-12N-18W	Bell's Harse	3,509	Arbuckle	Seismograph
Sherman	19-15N-14W	Carter's Strat. test 4	3,497	Arbuckle	Chance
Sherman	22-15N-14W	Bell's Michalous	3,471	Arbuckle	Seismograph
Antelope	31-25N-6W	Cave & Wenhoff's Taylor 1	2,100	?	Magnetometer and soil analysis
Antelope	31-25N-6W	Cave et al. Taylor 1A	2,625	Pre-Cambrian	Magnetometer and soil analysis
1943 EASTERN NEBRASKA WILDCATS					
Richardson	16-1N-17E	Skelly's Strat. test 19	2,475	Hunton	Core drill
Richardson	15-1N-17E	Skelly's Strat. test	1,570	Cherokee	Core drill
Richardson	2-2N-15E	Ferguson & Towle	2,520	Hunton	Core drill and Seismograph
Johnson	4-4N-12E	Stanolind's Strat. test 6	•	•	•
Johnson	5-5N-12E	Stanolind's Strat. test 5	•	•	•
Johnson	6-6N-12E	Stanolind's Strat. test 4	•	•	•
Otoe	22-7N-11E	Stanolind's Strat. test 2	•	•	•
Otoe	11-7N-10E	Stanolind's Strat. test 1	•	•	•
Otoe	25-7N-12E	J. M. Conner's Ritter	2,532	Pre-Cambrian	Chance

* Confidential information.

wildcats in 1943 were drilled by reputable companies and penetrated the complete stratigraphic column. Considerable additional stratigraphic information has been gained by these tests, but very few showings of oil are recorded.

Development of producing areas in Nebraska had practically ceased by the end of 1943. The cumulative production in Nebraska, January 1, 1944, was approximately 4,142,000 barrels, of which 3,347,000 barrels was produced in the Falls City pool, and 615,000 barrels in the Barada pool. The Schubert pool has produced about 108,000 barrels, and the Dawson pool about 72,000 barrels.

DEVELOPMENTS IN OKLAHOMA IN 1943¹

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ABSTRACT

Oklahoma produced 121,697,740 barrels of crude oil during 1943, a decline of 16,299,527 barrels from 1942. While national production increased 8.3 per cent Oklahoma production decreased 11.8 per cent. Louisiana has replaced Oklahoma as the third ranking state.

Reserves for the state declined also. New discoveries and extensions added about 62½ million barrels to proved reserves, but this is 59 million barrels short of the annual production of 121½ million barrels. Oklahoma's proved reserves are estimated to be 908,618,000 barrels, by the A.P.I. committee on reserves.

There were 1,187 wells drilled during 1943, 336 of which were wildcat or exploratory wells. These resulted in the discovery of 34 new oil pools, 10 new gas pools, and 38 extensions and new producing formations. Most of the new discoveries are small, and will have little effect on future production or reserves. The West Edmond pool, producing from the Hunton limestone, is the most important discovery of the year. The trend toward deeper drilling is reflected in the increase from 9 to 15 in the number of wells in Oklahoma which have reached or exceeded 10,000 feet in depth.

Geophysical activity decreased sharply, both in the number of crew months of work, and the types of work. Seismograph and gravimeter are the only types reported. Core drill and stratigraphic holes were reduced in number.

The most important event of the year was the discovery of oil on the west flank of the "granite ridge" in central Oklahoma, which has opened the entire west flank of this ridge and the Anadarko basin to additional oil prospecting.

INTRODUCTION

The position of Oklahoma among the petroleum-producing states did not improve during 1943. With national production at a new maximum of 1½ billion barrels, Oklahoma production dropped to the lowest it has been in 22 years. Not since 1921 has Oklahoma's production fallen below 125 million barrels. Five states produced 80 per cent of the national production and in two of these states production declined. Estimated reserves declined in three of these states. In only one of the leading states (California) did production and reserves both increase during 1943. Texas, with an increase of 111,301,000 barrels (27 per cent) of production, decreased her reserves by 220,000,000 barrels. Oklahoma reserves were decreased nearly 60,000,000 barrels, or 6 per cent. National proved reserves are placed at 20,064,152,000 barrels, a decline of 18,640,000 barrels.

With the end of the war not yet in sight it behooves every geologist to expend every possible effort toward the discovery of new oil reserves.

DEVELOPMENT

Oklahoma produced 121,697,740 barrels of oil in 1943,³ which is 16¼ million

¹ Presented by title before the Association at Dallas, March 22-23, 1944. Manuscript received, March 17, 1944.

² Pure Oil Company. The assistance of numerous companies and individuals in supplying data, checking information, typing and proof reading the manuscript, *et cetera*, is acknowledged and appreciated. Insofar as possible companies have been given the opportunity to check the data as published on their wells.

³ Production figures are taken from the Oklahoma Corporation Commission's Report on Pipe Line Runs for 1943.

barrels less than the 1942 production of 137,997,267 barrels and represents a decline of 11.8 per cent. Proved reserves also declined 59 million barrels,⁴ being estimated at 908,618,000 barrels as of December 31, 1943. Oklahoma is credited

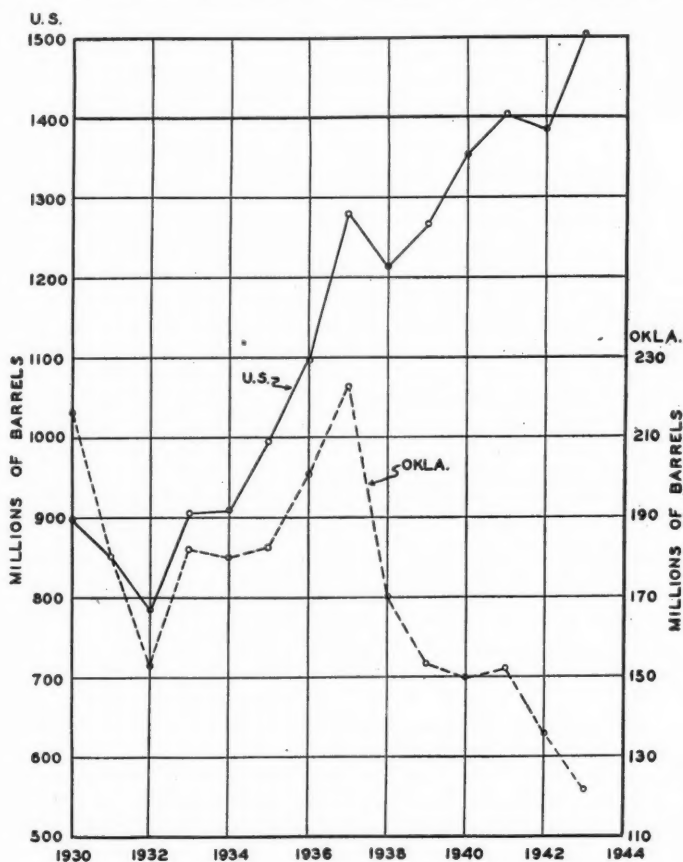


FIG. 1.—Graph showing relation of Oklahoma production to national production, 1930-1943.

with discovering $50\frac{1}{2}$ million barrels of new oil and adding slightly more than 12 million barrels by extensions and revisions, or a total of nearly $62\frac{3}{4}$ million barrels added reserves. Against this discovery, Oklahoma produced $121\frac{1}{2}$ million barrels, or a net loss of 59 million barrels.

⁴ Figures on state and national reserves are taken from the February 19, 1944, report of the American Petroleum Institute's Committee on Petroleum Reserves.

TABLE I
COMPARATIVE PRODUCTION, IN BARRELS, OF SIX LEADING COUNTIES

County	1943 Production	Percentage	1942 Production	Percentage
Oklahoma	22,074,490	18.1	27,629,133	20.0
Seminole	15,988,282	13.1	18,537,974	13.4
Osage	10,847,816	8.0	11,615,305	8.4
Carter	7,923,029	6.5	8,909,380	6.5
Creek	7,750,060	6.4	7,893,953	5.7
Pottawatomie	7,347,695	6.0	10,446,442	7.6
	71,931,372	59.0	85,032,187	61.6

As in past years more than 50 per cent of the state oil was produced by five counties, as shown in Table I. It is interesting to note that Pottawatomie County is no longer in the top five and has been surpassed by both Carter and Creek counties. The addition of the sixth county makes the table include all the counties which average in excess of 500,000 barrels of production per month. While production in these 6 counties represents 59 per cent of the state's total production the decline in production of 13 million barrels represents 80 per cent of the total decline for the state.

Drilling operations were about the same as last year, with 1,187 wells in 1943 compared to 1,191 in 1942. Exploratory wells however increased from 253 to 336, an increase of 33 per cent, which resulted in 44 new oil and gas pools for the year compared to 39 in 1942. Twenty-eight per cent of all wells drilled in 1943 were exploratory wells, compared to 21 per cent in 1942. However, the rate of discovery dropped from one discovery to each 5.6 wildcat wells in 1942 to one discovery to each 6.8 wildcat wells in 1943. (This does not include extensions and new producing formations.)

TABLE II
COMPARATIVE BREAK-DOWN OF WELLS DRILLED IN 1942 AND 1943

	Total	Exploratory Wells					Total	Pool Wells
		Oil	Gas	Dry	Ext.	N.Fm.		
1943	1,187	34	10	254	23	15	336	851
1942	1,191	32	7	178	21	15	253	938

The trend toward deeper drilling is evidenced by the completion of 4 wells in excess of 10,000 feet, the continued drilling of a fifth, and the drilling of two more which passed the 10,000 foot mark in January, 1944. The list of deep tests in Oklahoma thus increased from a total of 9 at the close of 1942 to 15⁵ by the end of January, 1944, and this list will be materially increased before 1945. Three of the deep tests completed in 1943 are discussed under Important Dry Holes.

DISCOVERIES

The rate of discovery of new oil and gas fields was increased slightly during

⁵ One of the wells completed in 1943 had reached a depth in excess of 10,000 feet in 1942 and is included in the 9 for that year.

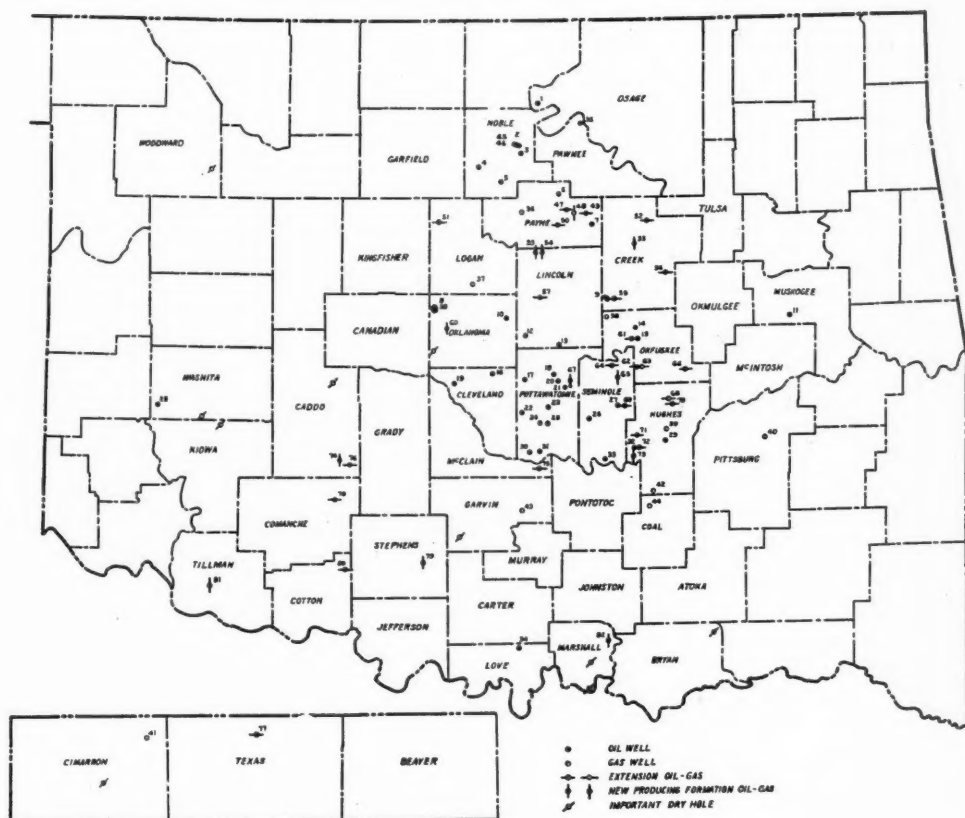


FIG. 2.—Map showing new pools, extensions, new producing formations, and important dry holes drilled in 1943.

the past year. This was accomplished by increasing the number of exploratory wells drilled from 253 in 1942 to 336 in 1943 (Table II). This resulted in the discovery of 34 new oil pools, 10 new gas pools, and 38 extensions and new producing formations. In spite of the fact that this is 5 more new oil and gas pools than were discovered in 1942 it should not lead to optimism. Table III, which lists all the discoveries for 1943, indicates that 20 of the 34 new oil pools were one-well pools at the end of the year and many of them have slight chance for additional development. Obviously such pools are of little importance from the standpoint of future reserves.

A brief description of the more important pools of the year follows.

TABLE III
NEW POOLS—EXTENSIONS AND NEW FORMATIONS DISCOVERED IN 1943

Index No.	Location	County	Field	Operator	Farm	Date	Producing Formations	Depth (Feet)	Total Depth (Feet)	Depth Plugged Back (Feet)	Initial Production	Development
NEW OIL POOLS												
1	20-25-3E	Osage	Big Bend	Oliphant & Bowers	Osage	4-13	Layton	2,852	3,831	2,875	273	1 oil
2	14-22-1E	Noble	E. Otee	Superior	Gillham	3-16	Tonkawa	2,552	4,669	3,393	Pt.-P. 10 oil-35 wtr.	1 oil
3	25-22-1E	Noble		Barnsdall & Sohio	Johnson	11-1	Mississippi	4,395	4,755	4,414	A-S-Fl. 14	1 oil
4	12-21-2W	Noble	NE Sams	Atlantic	Bolden	3-29	Misener	5,954	5,251		Pt.-A-Fl. 300	2 oil-1 drlg.
5	1-20-11E	Noble	SE Perry	Blackwell	Wood	8-30	Ferry	3,494	3,555		Pt.-Fl. 106 oil-45 wtr.	2 oil-1 drlg.-1 loc
6	1-20-11E	Payne	SE Perry	Stanford-Amerada	Ingham	3-2	Misener	4,031	4,156	4,065	Pt.-Fl. 192	1 oil-1 dry
7	9-18-6E	Payne	W. Markham	Olds Gasoline								
8	32-12-4W	Oklahoma	W. Edmond	Gutowsky	Potts	3-30	1st "Wilcox"	3,568	3,595		P. 49	2 oil-1 dry
9	8-14-7E	Creek	SE Stroud	Fleet #1	Wagoner	5-3	Huntton	6,877	7,600	7,044	Pt.-Fl. 520	16 oil-18 drlg.-5 loc.
10	9-13-1E	Oklahoma	S. Luther	Stanolind	Adams	4-12	Prue	2,860	2,934		S-Fl. 127	11 oil
11	16-13-17E	Muskogee	Oklahoma	Garrett	Johnson	1-3	Huntton	5,550	5,885		Pt.-A-P. 38	1 oil
12	10-12-2E	Lincoln	W. McClellan	Stanolind	Escoe	3-22	Wainwright	1,778	1,785		P. 12	1 oil
13	33-12-1E	Oklahoma	N. McClellan	Mid-Continent	Leonard	4-19	1st "Wilcox"	5,035	5,064		Pt. 205	3 oil-1 drlg.-1 dry
14	33-12-1E	Oklahoma	S. Meeker	Mid-Continent	Fowler	9-27	1st "Wilcox"	3,342	3,522		Pt. 115	1 oil
15	24-12-8E	Oklahoma	NE Dill	Mid-Continent	Crutcher	12-7	Duchet	3,488	3,594	3,535	S-P. 61	1 oil
16	11-10-1W	Cleveland	Stella	Deep Rock	Harris	7-26	Cromwell	6,498	6,605	6,511	Pt.-A-Fl. 346	2 oil
17	28-10-2E	Pottawatomie	Lake Shawnee	Atlantic	Bleeker	5-24	1st "Wilcox"	5,877	5,885		Fl. 499	1 oil-4 dry
18	24-10-3E	Pottawatomie	SW Shawnee	Mid-Continent	Muck	9-17	Huntton	5,108	5,511	5,168	Pt.-A-Fl. 29	1 oil
19	29-10-3W	Cleveland	W. Moore	Atlantic	Harris	12-6	2d "Wilcox"	8,780	8,792		Fl. 222	1 oil-2 drlg.
20	6-9-1E	Pottawatomie	S. Shawnee	Balph	Poole	5-22	1st "Wilcox"	5,224	5,234	4,550	Fl. 103 oil-300 wtr.	1 oil-2 drlg.
21	10-9-4E	Pottawatomie	W. Burnett	Atlantic	Chilcoat	7-12	1st "Wilcox"	4,476	4,718		Pt.-A-P. 57 oil-20 wtr.	1 oil
22	19-9-2E	Pottawatomie	W. Burnett	Stanolind	W. Burnett	8-24	1st "Wilcox"	4,476	4,718		Fl. 353	1 oil-1 drlg.
23	32-8-2E	Pottawatomie	S. Brookville	Stanolind	Perkins	12-28	2d "Wilcox"	4,364	4,581	4,940	Pt.-A-Fl. 341	1 oil-1 drlg.
24	32-8-3E	Pottawatomie	S. Macomb	Kerlyn	Weaver	2-1	Huntton	4,070	4,431	4,760	Pt.-Fl. 616	3 oil-1 dry
25	34-8-3E	Pottawatomie	Wewoka Lake	British-American	Atwater	7-12	Huntton	4,560	4,650	4,640	Pt.-A-Fl. 50	1 oil-1 dry
26	20-8-6E	Seminole		Cradlock	Davis	11-1	Dolomite	4,335	4,500	4,429	Pt.-A-P. 100 oil-47 wtr.	1 oil
27	2-8-7E	Seminole		Haddock	Patterson	11-29	Booth	3,354	3,347		S-Fl. 140	1 oil
28	8-8-20W	Washita	W. Sentinel	Gulf	Hopkins	12-27	Granite Wash	5,542 &	9,081	6,580	Fl. 270	1 oil-1 loc.
29	29-7-10E	Hughes	Horn's Corner	Deep Rock	Price	6-16	Cromwell	6,363	9,882		Fl. 270	5 oil-1 dry-2 drlg.
30	27-6-2E	Pottawatomie	W. Wanette	Cities Service	Lamirand	10-25	Viola	3,836	5,394	5,187	A-P. 63 oil	1 oil
31	20-6-3E	Pottawatomie	Wanette	Watchorn	Sorrell	11-22	Viola	4,130	4,710		Pt.-Fl. 648	1 oil-1 dry-2 drlg.
32	21-6-3E	Hughes	S. Spaulding	Bradley Bros.	Echols	3-15	Booth	2,636	2,658		S-P. 221	1 oil-3 dry,
33	12-5-6E	Seminole	E. Tyrola	Blackwell	Fleet-		Thurman	1,745	1,809	3,250	P. 55	1 oil-1 gas-2 dry
34	6-6S-2E	Love	Overbrook	Mudge	Tanner	9-11	Thurman sd.	3,100	4,510		Pt.-P. 6	1 oil.
NEW GAS FIELDS												
35	2-23-5E	Pawnee	Ralston	Aladdin	Campbell	3-29	Oswego	2,620	3,635		Pt.-A. 2 M.	1 gas
36	26-10-2E	Payne	S. Stillwater	Berry	Fee	3-22	Skinner	4,001	4,728		Pt. 3 1/2 M.	1 gas
37	16-15-2W	Logan		Eason	State	8-16	Sp. Dolomite	5,080	6,241	4,160	Pt. 4 1/4 M.	1 gas
38	7-13-7E	Okluskee		Northern Ordnance	Blumenthal	8-21	Huntton	4,016	4,214	4,107	Fl.-A-13 M.	2 gas-1 drlg.
39	8-7-10E	Hughes		Duke Gas & Deep Rock								1 gas
40	1-6-15E	Pittsburg	Rheams	Schene	Turner	7-26	Cromwell	3,544	4,744	3,585	Pt. 1 1/2 M.	1 gas
41	16-5-8E	Cimarron	Keyes	Pure	Schudel	3-1	Hartshore	1,058	2,204		S. 3 M.	4 gas
42	33-4-9E	Hughes	Citra	Northern Ordnance	Cox	5-8	Penn. sand	4,680	6,280	4,770	Pt. 10 M.	1 gas
43	17-3-2E	Garvin	E. Pauls Valley	Ohio	Hamilton	12-22	Cromwell	4,228	4,231		32 M.	1 gas
44	22-3-9E	Coal	Lula	Stanolind-Amerada	Burns	8-9	Penn. sand	2,881	4,330	3,032	Pt. 129 M.	1 gas
					Cushing	8-9	Cromwell	3,522	6,174	3,800	Pt. 18 1/4 M.	2 gas
					Royal							

TABLE III—Continued

Index No.	Location	County	Field	Operator	Form	Date	Producing Formation	Depth (Feet)	Total Plugged Back (Feet)	Initial Production	Development
EXTENSIONS AND NEW PRODUCING FORMATIONS											
45	13-22-E	Noble	E. Otee	Davon	Donahoe	7-5	Layton	3,204	3,239	P. 80	2 oil-1 dry
46	E. Otee	Noble	E. Otee	Superior	Mangrum	9-27	Ferry	2,886	3,246	Pt.-Fl. 42	3 oil-1 drlg.
47	25-19-4E	Payne	E. Ingalls	Crosby	Waltson	11-17	Misener	3,730	3,776	Pt.-Fl. 336	1 oil-2 drlg.
48	30-19-4E	Payne	V. Ingalls	McIntyre	Waltson	11-17	Misener	3,680	3,776	Pt.-Fl. 336	1 oil-2 drlg.
49	5-18-4E	Payne	V. Ingalls	McIntyre	Waltson	11-17	Misener	3,680	3,776	Pt.-Fl. 336	1 oil-2 drlg.
50	5-18-4E	Payne	V. Ingalls	McIntyre	Waltson	11-17	Misener	3,680	3,776	Pt.-Fl. 336	1 oil-2 drlg.
51	9-18-4W	Logan	N. Rinley	Berry	Sherrill	6-14	ad "Wilcox"	4,166	4,203	Pt. 2 M.	1 gas-2 drlg.
52	0-18-4W	Logan	N. Rinley	Champlin	Fry	10-11	Pawhuska	3,305	6,220	Pt. 5 M.	1 gas-2 drlg.
53	0-18-4W	Logan	N. Rinley	Champlin	Jackson	4-5	ad "Wilcox"	3,179	3,187	Pt.-P. 7 oil-5 wtr.	1 oil
54	20-17-3E	Lincoln	Sporn	Skelly	Speer	12-13	True	3,930	4,065	Pt.-P. 25	1 oil
55	22-17-3E	Lincoln	E. Sporn	Haddock	Hert	9-13	Skinner	3,935	4,555	Pt.-Fl. 100	1 oil-1 dry
56	27-16-10E	Creek	Slick	Whitfield & Cobb	Johnson	8-16	Red Fork	2,592	2,933	Pt.-P. 63	2 oil-2 drlg.
57	3-14-34W	Creek	W. Edmond	Great Lakes Carbon	Wetover	7-7	Bartlesville	2,604	2,947	Pt.-P. 44	1 oil-2 drlg.
58	10-14-4E	Creek	Hickory Grove	Sun	Cargill	11-15	Bartlesville	6,735	7,585	S.-Fl. 80	1 oil
59	33-13-3W	Oklahoma	Britton	Peppers	Fry	4-13	Oswego	2,730	3,375	Pt.-A.-P. 80	2 oil-2 dry-1 drlg.
60	33-13-3W	Oklahoma	Dill	McIntyre	Britton	7-26	Cromwell	3,646	3,959	S.-P. 55 oil-40 wtr.	1 oil
61	31-11-9E	Okluskee	E. Cronwell	Titus	Lincoln	11-15	Cromwell	3,414	3,422	Fl. 246 oil-10 wtr.	2 oil-3 dry
62	31-11-9E	Okluskee	E. Cronwell	Danciger	Palmer	12-20	Cromwell	3,374	3,381	84 M. gas	1 oil-3 drlg.
63	31-11-9E	Okluskee	Sylvian	Kerlyn & Continental	Scott	1-21	Misener	4,186	4,310	Fl. 14 oil-13 wtr.	1 gas-1 drlg.
64	3-10-7E	Seminole	N. Bethel	Wrightman	May	12-6	1st "Wilcox"	4,445	4,450	S.-P. 120	1 oil
65	25-10-1E	Okluskee	Wetzelia	Bryant & Moffat	Nuckols	5-10	Gilcrease	2,668	2,669	S.-P. gas	2 gas
66	0-10-1E	Pottawatomie	S. Wetumka	Atlantic	Turner B	2-15	Hutton	4,150	4,300	Pt.-A.-Fl. 200	7 oil-1 drlg.
67	1-9-4E	Hughes	NE. Wewoka	Creekmore et al.	Danenburg	3-8	Gilcrease	2,805	2,845	2 M. gas	1 gas
68	35-9-10E	Seminole	Hughes	Jordan	Youngblood	6-7	Dolomite	4,215	4,270	414	1 gas
69	8-8-8E	Hughes	W. Holdenville	Grimes	Haney	12-27	Gilcrease	2,830	2,856	84 M. gas	1 gas
70	1-8-10E	Hughes	W. Holdenville	Bartlett & Crum	Fream	8-9	Gilcrease	3,003	3,373	Pt.-P. 60 oil-50 wtr.	1 oil
71	27-7-8E	Hughes	S. Spaulding	Brantley Bros.	Brantley	6-22	Brantley	2,635	2,635	Pt.-P. 25	1 oil-3 dry
72	28-6-8E	Hughes	S. Spaulding	Brantley Bros.	Brantley	6-22	Brantley	2,635	2,635	Pt.-P. 25	1 oil
73	28-6-8E	Hughes	S. Spaulding	Brantley Bros.	Brantley	6-22	Brantley	2,635	2,635	Pt.-P. 25	1 oil
74	15-4-5W	McClain	Brays	Kubat	Parter	4-12	Meitran	5,510	5,510	Fl.-Fl. 588	9 oil-17 drlg.-1 dry
75	21-5-3E	McClain	Cement	Kubat	Parter	2-1	Meitran	3,468	3,487	Fl. 100	6 oil-1 dry
76	10-5-9W	Caddo	Hugoton	Ohio	Kla-da-ing	11-12	Marchand	6,263	6,579	Fl. 540	1 oil
77	20-5-10ECM	Texas	Cities Service	Tantlinger	No. 3	6-28	Perm. ls.	2,750	2,838	A. 30 M. gas	1 gas
78	8-3-10W	Comanche	Ft. Sill Resv.	Spencer	Shallow sd.	5-3	Shallow sd.	790	820	Pt.-Fl. 75	12 oil-5 gas-21 dry-4 drlg.
79	23-5-5W	Stephens	Valina	Phillips	Quinn	12-27	Perm. sd.	1,425	1,590	S.-P. 72	1 oil
80	32-5-9W	Wagoner	Wagoner	Phillips	Quinn	12-27	Perm. sd.	1,425	1,590	S.-P. 72	1 oil
81	32-5-9W	Wagoner	Wagoner	Phillips	Quinn	12-27	Perm. sd.	1,425	1,590	S.-P. 72	1 oil
82	28-5-7E	Marshall	Cumberland	Keen	Hinson	5-3	Canyon	2,895	3,417	Pt.-P. 15 oil-3 wtr.	1 oil
83	28-5-7E	Marshall	Cumberland	Pure	Little tor-7	6-18	Oil Creek	6,272	6,325	Fl. 3,648	7 oil-3 drlg.

Index numbers refer to Figure 2.

Under Initial Production

Pl.=Perforated; Fl.=Flowed; P.=Pumped; A.=Acidized; S.=Shot; M.=Millions of cubic feet of gas. Production figures are in barrels unless otherwise noted.

EAST OTOE

Production in the East Otoe pool was discovered by the Superior Oil Corporation in recompleting Gillham No. 1, NE., SE., SE. Sec. 14, T. 22 N., R. 1 E., Noble County, in the Tonkawa sand. Subsequent drilling has added two new producing formations to this pool.

In September, 1936, Stanolind-Amerada abandoned Gillham No. 1 as a dry hole, after finding salt water in the second Simpson (Ordovician) sand at 4,656-4,669 feet, total depth. Late in 1942 the Superior Oil Corporation took over this lease, cleaned out the old hole to 3,393 feet, ran 7-inch casing, and began to test Pennsylvanian sands. The Layton was perforated and yielded a hole full of water after which the Tonkawa, at 2,552-2,590 feet, was tested and yielded 10 barrels oil and 35 barrels water.

The Davon Oil Company then made location for Donahoe No. 1, Cen., SE., SW. Sec. 13, $\frac{1}{2}$ mile east of the discovery well. Failing to produce in the Tonkawa sand this well was drilled to the Layton, 3,204-3,229 feet, total depth, where it was completed, producing 80 barrels of oil and one barrel water on pump.

In September, the Superior completed Mangrum No. 1, Cen., NE., SE. Sec. 14, T. 22 N., R. 1 E., in the Perry "gas sand" topped at 2,889 feet after the Layton sand failed to produce. The 7-inch casing was set to produce from the Layton, but was perforated through the Perry sand when the Layton proved unproductive. Initial production was 42 barrels of oil daily.

The original Stanolind-Amerada dry hole was drilled on seismograph information. Superior made a seismograph survey of the area after the Stanolind-Amerada well was abandoned.

All production is from sands of Pennsylvanian age. No tests except the original dry hole have been drilled to lower formations.

The field, which is confined to Secs. 13 and 14, is $2\frac{1}{2}$ miles east of the Otoe City pool. At the close of the year there were 6 oil wells, 1 dry hole, and 2 drilling wells.

WEST EDMOND POOL

The first important production on the west flank of the "granite ridge" in central Oklahoma was discovered by Gutowsky *et al.* when Wagoner No. 1, NW., NW., SW. Sec. 32, T. 14 N., R. 4 W., was completed early in May, producing 520 barrels of 41° gravity oil from the Hunton limestone. Drilled on a location made without benefit of orthodox geology, it is the most important addition to Oklahoma reserves found in 1943. Located 15 miles northwest of Oklahoma City and 6 miles west of the Edmond pool, the new play contained 15 producing wells and 31 drilling wells, 6 of which were outlying wildcats or semi-wildcats, at the close of 1943. Production has been established in 7 sections, and drilling operations are spread over 13 sections. There are no dry holes.

Wagoner No. 1 drilled a normal upper section. The Bartlesville (Pennsylvanian) sand was cored, as was the Mississippian limestone, without success. The Hunton (Silurian-Devonian) limestone was topped at 6,877 feet, with a small

showing of oil reported, but this was not cored. Drilling proceeded to 7,664 feet, where an electrical survey was run and the well was shut down for orders since both the first and second "Wilcox" sands (Ordovician) had proved unproductive. It was then decided to test the Hunton and 7-inch O.D. casing was set and cemented at 7,103 feet, 226 feet in the Hunton. The well was plugged back to 7,044 feet and the casing was perforated between 6,951 and 6,956 feet with 11 shots, which yielded an estimated 5,000,000 cubic feet of gas and enough oil to make a few small flows. Continued testing resulted in a total of 47 shots placed between 6,938½ and 6,956 feet, and the well was completed, producing 520 barrels of oil daily through 9/32-inch choke on 2½-inch tubing. An estimated 1,000,000 cubic feet of gas daily accompanied the oil. Casing pressure was 1,050 pounds and tubing pressure 350 pounds per square inch.

A half mile north of the discovery well the Sohio Oil Company's Cargill No. 1, Cen. SE., SE. Sec. 30, T. 14 N., R. 4 W., was dry in the Hunton, but drilled on and tested both first and second "Wilcox" sands. At the total depth of 7,585 feet it was plugged back to 6,765 feet and shot between 6,735 and 6,747 feet, in the Bartlesville sand. The well was completed, producing 80 barrels of 40° gravity oil and 3 barrels of water daily.

The Wagoner and Cargill discovery wells are the only Ordovician tests.

With 15 producing wells on 40-acre spacing the pool has a proved area of 600 acres, but it seems not improbable that wells now drilling will increase this to at least 1,500 acres.⁶

Production is limited to the Bois D'Arc (Devonian) member of the Hunton limestone. The perforated zone within the Bois D'Arc varies between 40 and 75 feet in thickness and averages about 55 feet. There is considerable truncation on the top of the Hunton, the discovery well encountering 358 feet of limestone, though the Bartlesville discovery well had only 182 feet of Hunton.⁷

The Mississippian limestone is only 15-20 feet thick and in a few wells both the limestone and the underlying Chattanooga shale are absent, with beds of Cherokee (Pennsylvanian) age lying on the Hunton limestone.

The largest potential recorded is 1,605 barrels, but this well was acidized, and produced through 2½-inch tubing without choke. It is common field practice to cement the producing string of casing through the oil zone and then perforate the beds desired.

SOUTHEAST STROUD

A Pennsylvanian sand pool in the Stroud area was opened on April 12 when J. J. Fleet *et al.* completed Adams No. 1, Cen. SE., NW. Sec. 8, T. 14 N., R. 7 E.,

⁶ As of May 15 there were 54 producing wells (2,160 proved acres), 55 wells drilling or preparing to drill, and 14 outlying drilling wells, most of them north of the pool. Much of this activity is the result of a Hunton limestone producer in Cen. SE., SW. Sec. 7, T. 14 N., R. 4 W., completed early in May for 2,040 barrels of oil through one-inch choke.

⁷ A well completed since the first of the year in the north part of the field failed to find any Bois D'Arc limestone and was abandoned as a dry hole even though structurally higher than some of the producing wells.

in the southwest corner of Creek County, and between the old Stroud pool and the recently discovered (1942) Hickory Grove pool. The Prue (Pennsylvanian) sand was encountered at 2,860 feet and at the total depth of 2,874 feet the sand was shot with 25 quarts of nitroglycerine, and flowed 127 barrels of oil through open tubing with an estimated one million cubic feet of gas. In October the well was deepened to 2,934 feet, or 74 feet in the sand, and it was shot again with 120 quarts through the entire sand section. This increased production to 384 barrels daily.

The Prue is the only producing formation at present. Wells which have drilled the entire section and penetrated the underlying Verdigris limestone show a thickness of about 70 feet of sand and sandy shale. No wells have gone below the Verdigris limestone; thus, the lower Pennsylvanian sands, particularly Skinner and Bartlesville, as well as Mississippian and Ordovician formations, are still untested.

Present production is limited to Secs. 8 and 17. All of the wells are shot, many of them with heavy charges (up to 400 quarts) of nitroglycerine, and all wells flow. There is no water. Gravity of the oil is 44° - 46° . The largest potential is 384 barrels, but several of the wells have been completed for less than 100 barrels. Based on 40-acre spacing there are 520 acres proved productive.

Structure on the Oswego indicates this is a terrace.

The location of the discovery well was made because of an old gas well which was drilled in the SW., SW., NE. Sec. 8 in 1915. At the total depth of 2,836 feet (probably the top of the Prue sand) this well blew out with an estimated 25 million cubic feet of gas, caught fire, and burned the rig down.

WEST MOORE POOL

The West Moore pool was discovered by the Mid-Continent Petroleum Corporation whose Harris No. 1, NE., SE., SW. Sec. 29, T. 10 N., R. 3 W. was completed in the second Simpson (2d "Wilcox") sand (Ordovician) producing 178 barrels of oil at 8,792 feet, total depth. Though there are a few other Simpson producers west of the "granite ridge" in central Oklahoma, this discovery overshadows the others not only in potential production, but also because of the vast leasing activity and geophysical campaign resulting from it.

Spudded in mid-June the Harris No. 1 was drilled as a "tight hole." The industry was interested from the first because of the location on the west flank of the "granite ridge" and because of the recently discovered Hunton oil in the West Edmond pool 25 miles north. To add to the interest, Carter was drilling two deep tests (not yet completed) about 10 miles south of the Harris well. This combination of activity made everyone very conscious of the possibilities of opening a vast new province to production. Hence, when news "leaked out" that a showing of oil had been encountered, and a core taken in the Hunton, excitement ran high and there were visions of a second East Texas field flanking the "granite ridge," with production from porous Hunton limestone.

The well went on down and tested both first and second Simpson sands, the

latter topped at 8,780 feet, yielding soft saturated sand in a bottom-hole core at 8,787-8,792 feet. On drill-stem test the well flowed oil in 19 minutes and estimates of its producing ability ran high.

After being nearly lost, in the attempt to run casing, the well was put on production and flowed 65 barrels per hour on a 3-hour test through $\frac{1}{8}$ -inch choke. It produced 178 barrels of 39° gravity oil daily on 10/64-inch choke, with 2½ million cubic feet of gas.

On the top of the second Simpson sand the Harris well is about 1,500 feet lower than producing wells in the Moore pool, 7 miles east. This rate of dip is excessive, and suggests a deep syncline or fault separating the West Moore pool from the Moore field, but whether it is on a secondary ridge paralleling the "granite ridge" or on isolated structure is not known.

The Mid-Continent Petroleum Company worked the area with seismograph and gravimeter prior to making the location. Geophysical surveys of this township were made by most major companies in the past 14 years, using seismograph, gravimeter, torsion balance, magnetometer, and soil analysis.

At the close of the year two offset locations were being drilled.

HORNS CORNER

The discovery of both oil and gas in the Cromwell (Pennsylvanian) sand, in a wildcat drilled in Sec. 29, T. 7 N., R. 10 E. by the Deep Rock Oil Corporation, opened a new pool on the east flank of the Seminole uplift and opened a considerable area to additional prospecting.

The first well in the recent play was drilled by the Burke-Greis and the Deep Rock companies in Sec. 19, T. 7 N., R. 10 E. This well tested both first and second Simpson sands and at the total depth of 4,961 feet was plugged back to test the Cromwell sand, which on earlier tests had produced gas estimated at 5-10 million cubic feet daily. Exhaustive tests in this sand yielded some gas, but the accompanying water flow was too great to make the gas production commercial.

The Deep Rock then moved about 1½ miles southeast and spudded B. L. Price No. 1, in NE., NE., NE. Sec. 29, T. 7 N., R. 10 E., and drilled it to 3,882 feet, in the Cromwell sand topped at 3,866 feet. A bottom-hole core yielded soft saturated sand and a drill-stem test flowed 42° gravity oil at a rate estimated at 15 barrels per hour. On completion test the well flowed 572 barrels of oil with 14 million cubic feet of gas.

Subsequent development indicates a northeast-southwest trend to the pool with production limited at present to Secs. 21 and 29. Wells $\frac{1}{4}$ mile east and $\frac{1}{4}$ mile northwest of the discovery were abandoned as dry holes, indicating that the field will be limited to a small area.

The discovery well penetrated the producing sand 16 feet, but two of the producers were completed only 3 feet in the sand, and a third well which drilled

10 feet into the sand has produced some water from the first. An upper Cromwell sand member is non-productive and is usually cased off.

At the close of the year there were 5 producing wells, 1 dry hole, and 3 drilling wells.

Gas in the Cromwell was discovered in the Burke-Greis and Deep Rock No. 1 Turner, Cen., SW., NW. Sec. 8, T. 7 N., R. 10 E., about $2\frac{1}{2}$ miles north of the Horns Corner oil pool. At the total depth of 4,744 feet this well was plugged back to 3,585 feet to test the Cromwell topped at 3,544 feet, after the Simpson sands failed to produce. The Cromwell was perforated and the well produced $1\frac{1}{2}$ million cubic feet of gas daily with a spray of oil. It is doubtful if this gas area will ever connect with the oil field to form an oil and gas field of major proportions.

The discoveries in this township were based on seismograph survey of the area.

FORT SILL RESERVATION

This interesting shallow sand oil and gas field was discovered by The Texas

TABLE IV
DEVELOPMENT IN T. 3 N., R. 10 W., IN 1943

Sec.	Completions				Drilling	Largest Initial Production	
	Oil	Gas	Dry	Total		Oil	Gas
3	1		2	3		Pf., Fl. 7	
4			1	1			
5		1 (1942)	2	2	1		4M
8	7	3	1	11		Pf., Fl. 79	$4\frac{1}{2}$ M
9	1	1	2	4		Pf., P. 25 oil 12 wtr.	$\frac{1}{2}$ M
10			1	1			
14			1	1			
16	1		4	5	1	Pf., Fl. 6	
17	1	2	1	4		Pf., P. 2	$2\frac{1}{2}$ M
20		1	1	2	2		3M
21		1	1	2			$\frac{1}{4}$ M
22			2	2			
28			1	1			
29	1		1	2		S., P. 10	
Total	12	8	21	41	4		

Company's Ed Roll No. 1, Cen., SE., SW. Sec. 5, T. 3 N., R. 10 W., Comanche County, in September, 1942. The development of the field has been almost entirely in 1943, however, and on that basis it is included in this report.

The first oil in this area was discovered in 1925 when Becker and Reid completed two small wells in the SE., SW. Sec. 3, T. 3 N., R. 10 W., in shallow sands. The Perrio No. 1, Cen. SE., SW., produced 65 barrels of 34° gravity oil from a sand topped at 1,432 feet. The Perrio No. 3 produced 7 barrels of 35° gravity oil from a sand topped at 1,338 feet. A third well was completed in 1930, producing 6 barrels of oil and 12 barrels of water from a sand topped at 1,446 feet.

The area then lay dormant until 1942 when The Texas Company drilled Roll No. 1, Cen., SE., SW. Sec. 5, T. 3 N., R. 10 W., to the total depth of 8,078 feet in basal Simpson, and plugged it back to 974 feet, where it was completed, producing 4 million cubic feet of gas from a shallow sand topped at 947 feet. In May, 1943, The Texas Company completed Spencer No. 1, Cen., NW., NW. Sec. 8, T. 3 N., R. 10 W., less than $\frac{1}{2}$ mile southwest of the Roll well, producing 75 barrels of oil from a sand topped at 790 feet. This created much interest in the area and active lease and drilling campaigns were started. This resulted in the completion of 41 wells during 1943, with 4 wells drilling at the end of the year.

Production has been obtained in 9 sections,⁸ with dry holes in 5 additional sections. The erratic nature of the production makes it difficult to evaluate future development. The Texas' Roll No. 1, discovery well, has dry holes on three sides, all within $\frac{1}{2}$ mile of it. One of these dry holes is a northwest offset to the Spencer No. 1, extension discovery. A small gas well in Sec. 9 is offset with a dry hole. A small oil well in Sec. 16 is offset northeast and southwest by dry holes. In contrast to this, three wells located at half-mile intervals across the north half of Sec. 17 are all producers.

The producing sands are lenticular, comprising a sand zone rather than a definite sandstone and are believed to be Clearfork (Permian) in age. At least one well has developed production in lower arkosic sands of Wichita-Albany (Pontotoc) age.

Location of the field is at the northeast edge of the Fort Sill Military Reservation with 3 producers in Sec. 8, and one producer in Sec. 17 drilled as direct offsets to the reservation.

The location of the Roll well was made following an extensive seismograph survey in this area.

IMPORTANT DRY HOLES

Northern Ordnance, Inc., Bradshaw No. 1, Sec. 28, T. 22 N., R. 17 W., Woodward County, was abandoned at 10,073 feet after testing Simpson ("Wilcox"-Ordovician) sand topped at 10,031 feet. A showing of oil was noted in the samples, but a core taken because of this showing yielded white water sand. This is the deepest well in drilling depth in this area, but four other wells in northwestern Oklahoma, not counting the Panhandle, have tested the Simpson. The location was made on a Carter Oil Company seismograph play, farmed out to Northern Ordnance.

Youngblood's Swatek No. 1, Sec. 7, T. 11 N., R. 4 W., Oklahoma County, is one of the few deep tests west of the "granite ridge" in central Oklahoma. The location is 10 miles west of the Oklahoma City pool and 13 miles south of the newly discovered West Edmond pool. The Second Simpson sand (Second "Wilcox") was topped at 8,624 feet and was revealed to be hard white sand in a bot-

⁸ Since the wells in this pool are so widely scattered many of them are extensions, or even semi-wildcats. To list all such wells seems unnecessary, and would focus undue attention on the pool. Hence, only the discovery extension drilled in Sec. 8 is listed in Table III.

tom-hole core. The well was abandoned at 8,640 feet, after running electrical survey. On the base of the Pennsylvanian, the Swatek well is about 1,700 feet lower than the apex of the Oklahoma City field, but on Simpson formations it is about 3,500 feet lower.

The Denver Producing and Refining Company's Sah Cam No. 1, Sec. 33, T. 10 N., R. 10 W., Caddo County, was finally abandoned after a long and checkered career. Spudded in late March, 1935, as an offset to the Adah Noe No. 1 in Sec. 34, T. 10 N., R. 10 W., which produced from a Pennsylvanian sand topped at 9,985 feet after being plugged back from 11,230 feet, the Sah Cam was drilled to 10,084 feet where it was temporarily abandoned about the last of May, 1936, when no oil was found in the sand which produced in the offset well. In August, 1941, work started again on the Sah Cam and by mid-February, 1942, it had reached a depth of 13,842 feet where circulation was lost and the drill pipe stuck. A year was spent in fishing, attempting to drill by, cutting drill pipe *et cetera*, but in February, 1943, the pipe was cemented off and drilling was resumed at a plug-back depth of 8,950 feet. In early August, 13,738 feet of 5½-inch casing was set in hard cherty sand. Water, which was encountered at 13,796 feet where the formation softened, increased with drilling, and became noticeably hotter below 13,835. At 13,882 feet, the total depth, the well was flowing an estimated 8,000 barrels of water per day. The temperature of the water at the casing head⁹ was 178°F.

The well was finally abandoned late in September, 1943.

The original location was made on a block of approximately 50,000 acres taken in 1930-1931, and based on surface work by the late Clyde M. Becker.

The Gulf Oil Corporation's Perkins No. 1, Sec. 31, T. 8 N., R. 17 W., Washita County, was abandoned at 4,714 feet, in Viola (Ordovician) limestone.¹⁰ This well drilled 1,390 feet of Hunton limestone, 165 feet of Sylvan shale and dolomite, 735 feet of Viola, and 305 feet of Simpson (Ordovician) limestones, green shales, and thin sands. At 4,590 feet it passed from Simpson back into the Viola and was soon abandoned. Location was made after a seismograph survey.

The Kerlyn Oil Company's Greb No. 1, Sec. 1, T. 7 N., R. 17 W., Kiowa County, 5 miles east and a mile south of the Gulf's Perkins No. 1, was abandoned at 7,880 feet after drilling 1,625 feet of Hunton limestone and going about 425 feet into the Viola.

The Stanolind Oil and Gas Company's M. Burton No. 1, Sec. 28, T. 3 N., R. 6 E., CM., Cimarron County, was abandoned at 7,032 feet, in granite. It is the

⁹ The following analysis and other data about the water are published through the courtesy of R. G. Rapp, president of the Denver Producing and Refining Company.

Total solids @ 163°C., mg. per liter
Chlorides as Cl, mg. per liter

20,850

11,540

(signed) Wm. Furber Smith,
Oklahoma Testing Laboratories

¹⁰ Information just released is supplemental to the Gulf's Perkins. The Gulf's Groves No. 1, Sec. 6, T. 7 N., R. 17 W., ¼ mile southwest of the Perkins well, drilled 1,850 feet of Hunton, 115 feet of Sylvan, 657 feet of Viola, 998 feet of Simpson limestone, shale, and dolomite, and at 5,450 feet passed from Simpson (Ordovician) into Springer (Pennsylvanian) black shale. It was abandoned at 6,296 feet, in the Springer.

second granite test in the Oklahoma panhandle. Location was made after seismograph and magnetometer survey, and is about 20 miles southwest of the newly discovered Pennsylvanian sand Keyes gas field discovered by the Pure Oil Company's Cox No. 1. The producing sand in the Keyes well was unsuccessfully tested in the Standolind well.

The Amerada Petroleum Corporation's House No. 1, Sec. 2, T. 1 N., R. 3 W., Garvin County, was abandoned at 10,996 feet after drilling about 200 feet into Bromide (Ordovician) sands. A drill-stem test of the bottom 100 feet of this hole yielded only drilling mud. This well was drilled 2 miles north of the Robberson pool, where Cambro-Ordovician oil is produced, and where in two wells, granite was encountered,¹¹ at depths of less than 2,000 feet. The location is on the trend of the northwest-plunging Arbuckle Mountains about 10 miles northwest of the Arbuckle limestone (Cambro-Ordovician) exposure.

The Amerada made the location after a seismograph survey of the area.

Bert Fields *et al.* Wilson No. 1A, Sec. 13, T. 5 S., R. 12 E., gives another control point beneath the Cretaceous overlap for deposits of Ouachita Mountain facies. Spudded on the Goodland limestone, this well drilled out of the overlap into the Polk Creek shale and went 100 feet into the Big Fork chert (Ordovician). The location is 8 miles northeast of the Sinclair-Prairie's Irwin No. 1, Sec. 18, T. 6 S., R. 12 E., which encountered Arbuckle Mountain facies below the Cretaceous.

The Magnolia Petroleum Company's Beard No. 1, Sec. 7, T. 7 S., R. 6 E. Marshall County, was abandoned at 2,010 feet, after a bottom-hole core of dark greenish gray shale showed a dip of 83°. Controversy on the bottom-hole formation in this well ranged from Ouachita Mountain facies (possibly Stanley shale) to Pennsylvanian-Springer, or Sylvan (Ordovician) shale. The location is between the Madill and Preston anticlines and was based on a gravimeter survey.

The Texas Company's Beard Estate No. 1, Sec. 30, T. 8 S., R. 6 E., Marshall County, was abandoned at 2,056 feet, in Pennsylvanian strata when bottom-hole cores indicated nearly vertical dips. The location is on the Preston anticline about 4 miles south of the Isom Springs pool which produces from shallow sands, on the apex of this anticline.

EXPLORATORY METHODS

Exploratory methods were drastically curtailed during 1943, the industry employing only those methods which are known to give satisfactory results. No activity was reported in Oklahoma for magnetometer, soil analysis, or electrical resistivity. Even seismograph activity was reduced 63½ crew months and total geophysical work was down 99 crew months.

There were 35 seismograph parties operating in the state at the first of 1943, 29 parties the last week in June, and 41 parties at the close of the year. Most of the major companies maintained their rate of seismograph activity, the decline

¹¹ A. R. Denison, "The Robberson Field, Garvin County, Oklahoma," *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 7, No. 6 (June, 1923), p. 625.

noted being largely through the elimination of "odd job" work for independents and small companies.

The number of coreholes, both shallow and stratigraphic, were also decreased. Table V gives a summary of exploratory activity in 1943 compared with similar activity in 1942.

TABLE V
COMPARATIVE SUMMARY OF EXPLORATORY WORK IN 1943 AND 1942.

	Amount of Work		Number of Companies	
	1943	1942	1943	1942
Seismograph	294½	358 crew months	22	17
Gravimeter	66½	83 crew months	9	12
Magnetometer	No work	20½ crew months	—	4
Surface detail	9½	7½ crew months	—	3
Core drill	93	105 holes	4	5
Stratigraphic drill	16	44 holes	4	5

After the discovery of oil in the West Moore pool there was a concentration of geophysical activity in McClain, Grady, Cleveland, Canadian, Kingfisher, and other counties bordering the flanks of the "granite ridge."

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DEVELOPMENTS IN ROCKY MOUNTAIN REGION IN 1943¹

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ABSTRACT

Drilling activities on the basis of all wells making any footage increased from 504 in 1942 to 686 in 1943 in four oil- and gas-producing states of the Rocky Mountain region, an increase of 36 per cent. The number of wildcat and semi-wildcat wells increased from 81 to 164. The greatest increase was in Montana. Oil production declined slightly in Montana and northwestern New Mexico and increased in Colorado and Wyoming for an overall gain of 2.7 per cent. This was considerably less than the increase in 1941 and 1942. New discoveries included gas at Douglas Creek, Colorado, and Ingomar, Montana; and oil at Brady, East Utopia and Gage, Montana, and Gebo and Steamboat Butte, Wyoming. The most active new development was in the Tensleep sandstone pool at Elk Basin, discovered in 1942. Deeper formations developed new reserves in several other fields, such as the Madison limestone at South Oregon Basin and the Tensleep formation at Little Buffalo Basin, but some deep tests were disappointing. Geologic and geophysical work was very active, with several new companies entering the region and others preparing to do so in 1944.

INTRODUCTION

The district covered includes Colorado, Montana, Utah, Wyoming, and northwestern New Mexico. It also properly includes portions of Arizona, Idaho, Nevada, and North and South Dakota, but activities in those states are few and scattered, and they are non-productive, except for some local occurrences of gas. In some instances, the statistical information is confined for comparative purposes to the first four states.

DEVELOPMENT

Development, on the basis of wells drilling and footage drilled, was substantially greater than during any year since statistics were first compiled in 1930. Table I shows the wildcat and semi-wildcat and the total drilling activity in Colorado, Montana, Utah, and Wyoming during 1940, 1941, 1942, and 1943. The year 1942 was the least active, due to wartime uncertainties, including spacing and material restrictions, and 1943 was the most active, because of some moderations of drilling restrictions and an accelerated search for new reserves.

Table II shows the oil production in barrels by states during the past 4 years, and the grand accumulated totals to January 1, 1944.

Reserve figures as announced by the American Petroleum Institute in the *Oil and Gas Journal* of February 24, and the *Oil Weekly* of February 28, 1944, indicated that Colorado, Montana, and Wyoming developed 200,382,000 barrels in new reserves in 1943, most of which was credited to extensions and revisions, and had a net gain of 156,989,000 barrels, compared with a national loss of 18,641,000 barrels. Wyoming ranked second, with California first, in net gain, and was eighth in 1943 production and seventh in total reserves.

Colorado.—Sixteen oil wells were completed, as compared with 12 in 1942.

¹ Presented by title before the Association at Dallas, March 22-23, 1944. Manuscript received, March 31, 1944. Published by permission of the director of the Geological Survey.

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TABLE I
SUMMARY OF WELLS AND FOOTAGE DRILLED 1940 THROUGH 1943 IN FOUR STATES

	Colorado		Montana		Utah		Wyoming		Total	
	Wells	Footage	Wells	Footage	Wells	Footage	Wells	Footage	Wells	Footage
1943 Wildcat and Semi-Wildcat Listed	14	40,921	57	139,271	7	20,495	35	100,818	113	301,505
1943 Minor Wildcat and Semi-Wildcat	9	3,995	16	9,127	2	1,571	24	16,950	51	31,313
1943 Total Wildcat and Semi-Wildcat	23	44,886	73	148,398	9	22,066	59	117,468	164	332,818
1942 Total Wildcat and Semi-Wildcat	14	37,128	19	30,027	6	11,807	42	73,444	81	152,406
1941 Total Wildcat and Semi-Wildcat	22	28,594	38	60,195	6	1,712	42	68,397	108	158,898
1940 Total Wildcat and Semi-Wildcat	40	33,484	23	29,942	5	2,091	42	57,549	110	123,066*
1943 Total—All Wells	78	118,025	373	680,145	9	22,066	286	620,525	686	1,440,761
1942 Total—All Wells	54	107,492	265	464,858	6	11,807	179	483,025	504	1,067,182
1941 Total—All Wells	61	102,848	332	620,752	8	8,063	202	489,884	603	1,221,547
1940 Total—All Wells	64	78,548	295	553,251	9	14,208	233	496,004	601	1,112,011

Note: These figures are not based on starts or completions, but on total drilling activity, and include all wells starting, continuing, deepening, or completing during the year in the four states listed, except for possible wildcats in extreme southwestern Colorado, not compiled by the writer.

* Data from a different source.

Twelve were in the shallow Rangely field, one at North McCallum, one at Iles, and two at Wilson Creek. The only gas well completed was a new discovery at Douglas Creek. A deep well at Rangely, drilled to 7,173 feet in 1931-1933 and plugged back to 6,315 feet in the Weber quartzite, was placed on production in September, 1943, for the first time since its initial tests. Further deep drilling is expected in 1944. The North McCallum field was demonstrated to be commercial by a satisfactory new completion. It produces a gas which averages 94.5 per cent carbon dioxide and 5.5 per cent hydrocarbons, from which a light oil is condensed. A pilot plant was erected for recovering the oil and returning residue gas to the

TABLE II

State	1940	1941	1942	1943	Accumulated
Colorado	1,702,090	2,142,610	2,287,275	2,337,335	46,805,126
Montana	6,661,358	7,515,257	8,063,817	7,889,987	105,798,748
NW. New Mex.	248,453	410,575	474,390	433,290	8,542,848
Utah	3,275	3,635	1,685	0	197,310
Wyoming	25,906,481	30,332,819	32,855,795	34,226,990	599,130,458
Totals	34,521,657	40,410,896	43,682,962	44,887,602	760,474,490

(Compiled by the Geological Survey from various sources. Subject to revision.)

sands, and the field will be developed. South McCallum was considered to be non-commercial upon further drilling and will remain shut in.

Montana.—One hundred fifty-eight oil wells were completed; 80 at Cut Bank, 68 at Kevin-Sunburst, 5 in the new Elk Basin pool, and 5 scattered. Fifty-one gas wells were completed; 40 at Bowdoin and Cedar Creek, and 11 scattered. In 1942, 123 oil wells and 69 gas wells were drilled. Production at Cut Bank and Kevin-Sunburst declined about 300,000 barrels below that of 1942 despite the new wells. The Elk Basin pool produced 229,000 barrels of Tensleep oil from the Montana area, beginning in August. With more wells and for a 12-month period, it should produce much more in 1944.

Northwestern New Mexico.—Two gas wells were completed at Barker Creek and two at Fulcher Basin. Some shallow drilling was also done in the Hospah and Rattlesnake fields. The Continental Oil Company's Navajo No. 1, NE. $\frac{1}{4}$, SW. $\frac{1}{4}$ Sec. 13, T. 29 N., R. 19 W., drilled in 1942, had gas in the Ouray dolomite at 6,948-6,950 feet and was deepened to 7,036 feet in 1943, plugged back to 7,004 feet, and completed with an open flow of 33,000,000 cubic feet per day by the back-pressure method after acidizing. A second well, Rattlesnake No. 1-G, in the SE. $\frac{1}{4}$, SE. $\frac{1}{4}$ Sec. 13, was completed at 7,049 feet with an open flow of 17,300,000 cubic feet. This work was done by the Continental Oil Company under contract with the United States Bureau of Mines. The Government has constructed a plant at Shiprock to process the helium-bearing gas from these two wells.

Wyoming.—Field activities were greater, but the number of completions was slightly less, 102 oil wells and 5 gas wells in 1943, as compared with 106 oil wells and 6 gas wells in 1942. Among the oil well completions were: Big Muddy 2,

Byron 7, Cole Creek 10, Elk Basin 20, Frannie 4, Lance Creek 6, Lost Soldier 3, Maverick Springs 3, North Oregon Basin 16, Salt Creek 3 (Tensleep), South Oregon Basin 14, Steamboat Butte 3, Wertz 2, and 9 miscellaneous. The Elk Basin pool produced 1,989,000 barrels of Tensleep oil from the Wyoming area.

NEW FIELDS DISCOVERED

For additional data on the fields or areas described in the following sections, see Table III.

Colorado.—The only new discovery was the gas well of the Superior Oil Company at Douglas Creek, a large, previously untested structure, in which the Union and the Continental oil companies each have a third interest. The well was unsuccessful not only in the Weber quartzite, which is productive at Rangely, but also in other deep formations, and was plugged back and perforated opposite three sands in the Dakota and Lakota between 4,326 and 4,430 feet, for an initial production of 5,800,000 cubic feet with 1,680 pounds shut-in pressure. A companion well at South Douglas Creek was abandoned as a dry hole. Northwestern Colorado has several gas fields which will remain shut in until the gas is needed and the reserves are deemed to be sufficient to warrant building a pipe line to a market.

The Amerada Petroleum Corporation well at Clarks Lake, near the Wellington field, found water in the Sundance formation near the close of 1943, and was ready to plug back to test oil saturation in the upper Dakota or Muddy sand. Present information indicates that this well is a discovery in 1944.

Montana.—Oil was found in three new fields, Brady, East Utopia or Lothair, and Gage. Gas was found at Ingomar. Brady and East Utopia were discovered by The Texas Company. The Brady well was reported capable of a production of 12 barrels of 35° A.P.I. gravity oil in the Sunburst sand at 1,470–1,482 feet. The Madison limestone contained sulphur water. The East Utopia well found 20° A.P.I. gravity oil in the top of the Madison limestone at 2,578 feet, and on a 10-day test, averaged 19 barrels of oil and 10 barrels of water. The first well at Gage was completed in the Amsden formation at 5,965–6,100 feet for an initial production of 15 barrels of 34° A.P.I. gravity oil, after plugging back from the Madison limestone. A second well $1\frac{3}{4}$ miles east and $\frac{1}{2}$ mile north of the discovery, was completed in January, 1944, for a reported initial production of 358 barrels a day. A third well was drilling $3\frac{1}{4}$ miles east and $\frac{3}{4}$ mile south of the discovery well, and it is said that one or two rigs will be kept busy in 1944. Northern Ordnance, Inc., is credited with this discovery, and the gas discovery at Ingomar. The Ingomar gas is from the Amsden formation at a depth of 3,800–4,119 feet. It contains 82.63 per cent nitrogen, 12.75 per cent methane, 4.03 per cent ethane, and 0.59 per cent carbon dioxide and oxygen, and has a B.t.u. value of 202. Initial production was 8,200,000 cubic feet and the shut-in pressure 1,000 pounds. The second well on the structure is about one mile south and $\frac{1}{4}$ mile west of the discovery well. It is hoped that a more petroliferous gas, or oil, is present somewhere on the structure.

Another discovery was reported by Taylor Drilling Company at Pendroy,

TABLE III

Field or Area	County	Location	Operator	1943 Footage	Total Depth 12-31-43	Status 12-31-43	Producing Formation	Deepest Drilled
ARIZONA (Information incomplete)								
Havrebrook	Apache	NW NE 10-15-10E	Union Oil	3,850	3,850	Abd.	(Abd. 2,637, 1944)	Quartzite
Zuni	Graham	NE NE 33-5N-E	Robertson et al.	1,840	1,840	Abd.		
Wittmann	Mariquita	NE NE 33-5N-W	Peoples O. & G.	1,950	1,950	Susp.		
Phoenix	Mariquita	SW SE 2-1N-3E		?	2,450	Drig.		
Total (4)					10,090			
Copacabana	Boulder	SW SE 15-2N-70W	E. Swanson	2,090	3,000	Abd.		Pierre
Beaver Creek	Rio Blanco	NW NW 32-2N-90W	Frontier Ref.	7,153	3,008	Tag.-P.B.	(Old gas field)	Mesaverde
White River	Routt	SW SW 32-4N-80W	Stanolind O. & G.	4,454	4,454	Abd.		Red Beds
Axial Basin	Moffat	SW NE 24-5N-94W	Karr & Greer	85	2,395	Susp.		Dakota
Buckingham-								
New Raymer	Weld	SW SW 14-7N-50W	Ramsey Petrol.	5	7,005	Abd.	(Muddy--1944)	Morrison
Clark's Lake	Larimer	SW SE 15-9N-48W	Amerinda Petrol.	6,510	6,510	Tag.-P.B.		Sundance
So. Dry	Fremont	SE SE 17-5N-60W	Refining Co.	3,008	3,008	Abd.		Shinarump
El Dorado	Boulder	SW NW 37-5N-60W	Superior Oil	1,793	8,558	Gas-NP.	Dakota-Lakota	Lakota
Crook Creek	Rio Blanco	NW SW 5-3S-101W	Superior Oil	7,016	7,016	Abd.	(Gas showings)	Pennsylvanian
Webster Creek	Rio Blanco	NW SE 12-6S-102W	Juhan & Smith	1,435	2,005	Susp.		Marmaton
Kitt Carson	Cheyenne	NW SE 22-6S-94W	O. E. Torrey	3,000	3,000	Drig.	(Abd. 4,261, 1944)	Wingate-Granite
Las Animas	San Juan	SE NW 24-1S-49W	Barney Oil	1,850	1,850	Susp.		
Garcia	San Juan	SE NW 32-3S-63W	Phillips Petrol.	1,025	1,025	Abd.		
Archuleta	Archuleta	SW SW 12-32N-7E		40,921	68,730			
Total (14)								
MONTANA								
Broadview	Yellowstone	SE NW 18-3N-23E	Broadview Petrol.	100	5,238	Drig.		Madison
Harlo	Wyandall	NW NE 13-7N-18E	Mon-o-co Oil	3,128	3,228	Drig.		Amesden
Gage	Musselshell	SE NE 14-9N-20E	Northern Ordinance	5,310	5,310	Drig.	(Oil, 5,125, 1944)	Madison
Gage	Musselshell	SE NE 15-9N-20E	Northern Ordinance	7,495	7,495	Drig.		
Ingram	Rosebud	NE SW 22-2N-22E	Northern Ordinance	4,810	5,810	Gas-NP.		Madison
Ingram	Rosebud	NW SE 27-9N-35E	Northern Ordinance	1,840	1,840	Drig.		
Crosser	Fergus	NW SE 6-20N-18E	Emmons et al.	40	2,280	Susp.		Madison
Conrad Butte	Pondera	SW SE 2-28N-1E	Texas Co.	2,024	2,024	Abd.	Showing oil	Madison
Dunkirk	Toole	SW NE 4-31N-1E	Lucky Seven Oil	1,754	1,754	Susp.		Madison
Dunkirk	Toole	SW NE 29-32N-1E	Texas Co.	1,590	1,590	Abd.		Madison
East Shelby	Toole	SE NE 27-32N-1E	Northern Ordinance	1,605	1,605	Abd.		Madison
East Shelby	Toole	NW NW 30-32N-2E	Northern Ordinance	2,570	2,570	Drig.	Madison	Madison
East Utopia	Liberty	SE SE 16-33N-4E	Texas Co.	2,464	3,364	Susp.		Kootenai
Hingham	Hill	SE NW 25-33N-10E	Hingham-Hobson	45	1,637	Abd.		Colorado
Havre	Hill	NW SW 25-33N-15E	Callison & Edwards	45	2,158	Abd.		Madison
East Kevin	Toole	NW SW 2-34N-1E	Northern Ordinance	2,158	2,158	Abd.		Madison
East Kevin	Toole	NW NE 25-35N-1E	Northern Ordinance	2,023	2,023	Abd.		Madison
East Kevin	Toole	NE NE 25-35N-1E	Northern Ordinance	1,863	1,863	Abd.		Madison
East Kevin	Toole	NE SE 34-35N-1E	Northern Ordinance	1,863	1,863	Abd.		Madison
East Kevin	Toole	NE NE 36-35N-1E	Northern Ordinance	1,903	1,903	Susp.	(4,500 M. gas)	Madison
Lost Creek	Liberty	NW NE 26-27N-7E	Smith et al.	1,487	3,002	Drig.	(Abd. 1,926, 1944)	Big Snowy
Farmington	Teton	NW SE 16-25N-4W	Texas Co.	1,915	1,915	Drig.		Madison
Teton	Teton	NE SE 27-25N-7W	Northern Ordinance	4,278	4,278	Abd.		Madison
Teton	Teton	SE NE 5-26N-7W	Northern Ordinance	3,925	3,925	Abd.		Madison
Trudy	Pondera	SE NE 21-27N-1E	Texas Co.	1,725	1,725	Drig.		Madison
Pendroy	Teton	NE SE 7-27N-5W	Taylor Dbb.	3,758	3,758	Susp.	Sunburst	Devonian
Pendroy	Teton	NE NW 18-27N-5W	Jarvis & Marcelle	2,932	2,932	Abd.	(Madison-O. & W.)	Madison

TABLE III—Continued

Field or Area	County	Location	Operator	1943 Footage	Total Depth 12-31-43	Status 12-31-43	Producing Formation	Deepest Drilled
MONTANA (Continued)								
Conrad-Midway	Pondera	SE NW 20-28N-1W	Hageman & Pond	1,766	1,766	Oil-Ex.	Sunburst	Sunburst
Conrad-Midway	Pondera	SW NW 28-28N-1W	R. C. Tarrant	1,748	1,748	Abd.		Ellis
Conrad-Midway	Pondera	NE NW 32-28N-1W	R. C. Tarrant	1,615	3,670	Drilg.	(Sunburst-showing)	Devonian
Dupuyer	Pondera	NE SE 26-28N-2W	R. C. Tarrant	200	1,736	Abd.		Sunburst
Dupuyer	Pondera	NE SE 9-28N-6W	Northern Ordinance	3,115	3,115	Abd.		Kootenai
Dupuyer	Pondera	NE SE 13-28N-7W	Northern Ordinance	3,701	3,701	Abd.		Madison
Blacktail	Pondera	NW SE 6-28N-8W	Northern Ordinance	5,937	5,937	Susp.		Madison
Marias River	Toole	NW NW 4-30N-8W	A. B. Cobb	1,535	1,535	Gas-Ex.	Colorado	Madison
Kevin-Sunburst	Toole	NW SE 11-31N-3W	Northern Ordinance	1,608	1,608	Abd.		Colorado
Aloe	Toole	SW NW 14-33N-3W	Northern Ordinance	1,824	1,824	Abd.		Madison
Aloe	Toole	NW NW 26-34N-3W	Northern Ordinance	1,715	1,715	Abd.		Madison
Red Creek	Toole	NW NW 30-34N-3W	Northern Ordinance	1,864	1,864	Abd.		Madison
Kevin-Sunburst	Toole	SW NW 2-35N-4W	Northern Ordinance	2,688	2,688	Abd.		Madison
Kevin-Sunburst	Toole	SW NW 3-35N-4W	Northern Ordinance	1,987	1,987	Drilg.	(Abd. 1,000, 1044)	Madison
Kevin-Sunburst	Toole	NW SE 6-30N-2W	Wash. O. Findig	1,160	2,410	Abd.		Madison
Red Creek	Toole	NE SE 24-30N-3W	Northern Ordinance	2,880	2,880	Abd.		Madison
Sweetgrass	Toole	NE NE 10-30N-4W	Northern Ordinance	2,275	2,275	Abd.		Madison
Border	Toole	NE NE 23-37N-2W	Northern Ordinance	2,593	2,593	Abd.		Madison
Border	Toole	SE SE 5-37N-3W	Northern Ordinance	2,701	2,701	Abd.		Madison
Kevin-Sunburst	Toole	SE SE 18-37N-3W	Northern Ordinance	2,952	2,952	Abd.		Madison
Border	Toole	NW SE 25-37N-3W	R. G. Parrant	2,860	2,860	Abd.		Madison
Border	Toole	SW NW 5-37N-3W	Northern Ordinance	2,997	2,997	Abd.		Madison
Toluca	Big Horn	NE SE 16-31N-1W	Dr. C. Peck	4,300	4,300	Drilg.	(Abd. 2,310, 1044)	Montana
Clarks Fork	Carbon	NW NW 25-08-22E	J. C. Peters	4,300	4,300	Abd.	Tensleep	Montana
Elk Basin	Carbon	SW NE 35-08-23E	Stanford O. & G.	5,752	5,752	Oil-Ex.		Tensleep
Seven Mile	Carter	NE SW 8-08-61E	P. Dickerson	950	1,550	Susp.		Colorado
New Mexico (Information incomplete)				130,271	164,007			
El Vado	Rio Arriba	NE NE 3-27N-2E	Helmerich & Payne	2,009	2,009	Abd.		Ignacio
Doctro	San Juan	NW SW 17-20N-18W	Continental Oil	6,920	6,920	Susp.	(N: gas)	Ignacio
Biclabito	San Juan	SW NE 13-30N-21W	Continental Oil	4,840	4,840	Abd.	(Showing N)	
Total (3)				13,769	13,769			
NEVADA								
Arden	Clark	NW SE 20-22S-60E	Red Star Oil	2,210	2,210	Abd.		
NORTH DAKOTA								
Linton	Emmons	NW SW 35-133N-75W	Northern Ordinance	5,359	5,359	Abd.		Pre-Cambrian
SOUTH DAKOTA								
Camp Crook	Harding	SW SW 1-17N-1E	Northern Ordinance	8,000	8,000	Abd.		Ordovician (?)
UTAH								
Coalville	Summit	SW SE 35-3N-5E	Longwall Petrol.	3 ?	4,372	Drilg.		
Diamond Fork	Utah	SE NW 16-8S-5E	Utah Drg. & Dev.	5,012	(3,201)*	Retrlg.		
Crecent	Grand	SE SW 33-21S-10E	Potash Co.	5,212	5,012	Susp.		Paradox
Crecent	Grand	SW SW 4-22S-10E	Black Drilling	5,212	4,420	Susp.		Paradox
Crecent	Grand	NW NW 10-25S-10E	Potash Co.	5,013	5,013	Abd.		Paradox
Crecent	Grand	NW NE 16-25S-10E	Potash Co.	5,250	5,250	Abd.		Paradox
Total (7)				20,495	20,072			

* Old depth 4,070 feet. Not counted in footage.

TABLE III—Continued

Field or Area	County	Location	Operator	1943 Footage	Total Depth 12-31-43	Status 12-31-43	Producing Formation	Deepest Drilled
WYOMING								
Steamboat Butte	Fremont	NW NW 5-3N-1W	British-Amer.	4,603	5,118	Oil-NP.	Sundance (?)	Sundance (?)
Maverick Springs	Fremont	NW SE 15-6N-2W	Continental Oil	3,228	3,228	Oil-PB.	(Embar)	Big Horn
Horse Creek	Laramie	SW NE 6-16N-58W	General Petrol.	3,490	6,116	Oil-PB.	Muddy	Chugwater
Wheat River Basin	Laramie	SW NE 21-11N-68W	Mountain Fuel	7,172	7,172	Oil-PB.	(Dakota)	Chugwater
Horse Creek	Laramie	SE SE 2-11N-68W	General Petrol.	1,971	4,316	Oil-PB.	(Lakota-1942)	Chugwater
Fossil	Lincoln	NW NW 31-21N-117W	Hatch & Harris	2,852	4,316	Susp.		Inglisite
Mid. Allen Lake	Carbon	SW NE 13-22N-70W	Ohio Oil	1,981	2,182	Abd.		Mowry
Bell Springs	Carbon	NE SE 32-24N-88W	Sinclair-Wyo.	4,466	4,466	Abd.		Deadwood
Bunker Hill	Carbon	SW SW 20-26N-87W	Sinclair-Wyo.	1,917	5,344	Tsg-PB.	(Tensleep-1941)	Madison
Pacific Creek	Fremont	NW NE 32-27N-90W	Superior Oil	474	9,392	Abd.		Madison
Fort Laramie	Sublette	SE NW 29-27N-102W	Superior Oil	3,458	3,458	Susp.		Wasatch
Fort Laramie	Sublette	SW NE 8-27N-133W	Wasatch Prod.	8,005	8,005	Abd.		Frontier
Big Piney	Sublette	SW NE 32-30N-113W	Wasatch Prod.	1,793	4,793	Susp.		Wasatch
Big Piney	Sublette	SE SE 11-32N-113W	H. H. Howell	1,793	4,793	Abd.		Wasatch
Brenning Basin	Converse	SE NE 11-32N-72W	Ohio Oil	3,930	3,930	Abd.		Dakota
Alpaca Creek	Natrona	SW SW 26-35N-80W	Dyer & Hayes	206	1,882	Drig.		Minnelusa
Lance Creek	Natrona	SE SW 31-36N-65W	Superior Oil	10,910	10,910	Abd.		Minnelusa
Segment Basin	Natrona	SE NW 4-36N-81W	Lakota O. & G.	750	3,288	Susp.		Pahasapa
Dewey	Weston	SW NE 36-42N-61W	W. H. Connor	90	2,890	Abd.		Newcastle
Dush Creek	Weston	SW NE 36-42N-61W	Western Oil Tr.	752	3,852	Drig.	(Oil-1944)	Tensleep
Delo	Hot Springs	NW SW 24-44N-63W	Continental Oil	5,399	5,399	Oil-NP.	Embar	Tensleep
Wahband	Hot Springs	NW SE 23-44N-63W	Continental Oil	2,460	5,399	Drig.	Embar	Tensleep
Osage	Weston	NE SE 16-46N-64W	Riggs Oil & Gordon	60	3,705	Abd.	(Oil-1944)	Morrison
Little Grass Creek	Hot Springs	SW NW 11-46N-90W	Goodstein-Cont.	2,000	2,000	Drig.		Tensleep
Little Buffalo Basin	Park	NE NW 13-47N-100W	Fred Goodstein	4,965	4,965	Oil-DT.	(Embar, show)	Big Horn
Gooseberry	Park	SW NW 28-47N-100W	General Petrol.	962	6,952	Abd.	(Abd., 5944-1944)	Madison
Little Buffalo Basin	Park	SW NE 34-48N-100W	Stanford O. & G.	5,218	5,218	Drig.		Madison
So. Oregon Basin	Park	NE NE 5-56N-100W	Yale Petrol. Co.	1,328	4,663	Oil-DT.	(Madison)-(P.B. Embar)	Big Horn
So. Fault Block	Park	NE SW 9-56N-100W	Kirk Oil	4,429	4,429	Oil-Ex.	Embar	Tensleep
Mooreton Basin	Crook	SE NW 18-51N-66W	Continental Oil	480	4,411	Abd.	(N. gas)	Deadwood
No. Oregon Basin	Park	SE NE 5-51N-100W	Ohio Oil	4,330	4,330	Oil-PB.	Embar	Madison
McCollough Peaks	Park	NE NW 28-54N-100W	Fred Goodstein	1,042	2,012	Abd.		Fort Union
Alkali	Big Horn	SE NE 33-55N-05W	Yale Oil	2,856	2,856	Drig.	(Abd. 3,325, 1944)	Madison
Francine	Park	SW SW 24-58N-98W	Kirk Oil	3,271	3,271	Oil-DT.	Madison	Madison
Elk Basin	Park	NE SE 36-58N-100W	Mule Creek Oil	5,574	5,574	Oil-Ex.	Tensleep	Amesden
Total (35)				100,818	138,060			

Note: Abbreviations used: Drig., drilling; Susp., suspended (for winter or other reasons); Tsg., testing; Abd., abandoned or plugged and abandoned; NP., new discovery pool; DT., deeper formation proved; PB., plugged back; Ex., extension (1 mile or more from any previous producer).

comprising 28.4° A.P.I. gravity oil in the Madison limestone at 2,541–2,551 feet. Initial production was reported as 67 barrels of oil and 33 of water per day. Increasing amounts of water caused the operator to revert to his original intention of testing the Devonian, and the well was finally suspended for the winter about 500 feet in that system. A discovery was reported in this area in 1939, but the well was soon abandoned, and it can not be considered an oil field.

Wyoming.—The first new discovery of the year was made by the British-American Oil Company at Steamboat Butte, a few miles northwest of the Pilot Butte field, which has produced light oil from sands in the Cody shale since 1916 and black oil from the Tensleep sandstone since 1942. At Steamboat Butte, gas was found in the first and third Frontier sands, light oil in the Dakota and Lakota, but the well was completed in the Sundance (?) formation (some believe it is a Jelm or Chugwater sand) with the productive zone at 5,093–5,118 feet. It was capable of producing about 600 barrels of 27° A.P.I. gravity oil, of the type commonly found in the Embar and Tensleep formations. This is practically the first Sundance production in the Wind River or Big Horn Basin, the only other recognized occurrence being in a shut-in well at Byron. Two more wells were completed, one located $\frac{1}{4}$ mile south and the other $\frac{1}{4}$ mile north of the discovery well. A fourth well, more than $\frac{1}{2}$ mile northwest, was 153 feet lower structurally on the Sundance sand and had poor saturation. Drilling was being continued to the Tensleep sandstone at the end of the year and present information is that this well will be a 1944 discovery in that formation.

Late in the year, the Gebo field was discovered by the Continental Oil Company. This dome has been known for many years. It was tested to the Cloverly formation by a 2,700-foot well in 1916 and a 2,904-foot well in 1925–1926, and to the Frontier sand by a 1,530-foot well in 1931. As these light-oil sands were water-bearing, interest lapsed until discoveries in the Embar and Tensleep formations in the Big Horn Basin again directed attention to the dome. The discovery well was drilled to 5,309 feet in the Tensleep sandstone and plugged back to produce from the Embar between 4,735 and 4,840 feet. Initial production was rated at more than 2,000 barrels a day of 28.9° A.P.I. gravity oil, but the well was shut in because of incomplete storage and marketing facilities. A sample of oil from the Tensleep sandstone has 17.8° A.P.I. gravity, and this formation also should be productive. More wells will be drilled in 1944.

NEW PRODUCING ZONES, SANDS, AND FORMATIONS

The only completions in new zones or formations were in Wyoming. The Horse Creek field made a new discovery in the Lakota sandstone in 1942. In 1943, a second well was drilled to the Chugwater formation and plugged back and completed in the Muddy sand. Then the discovery well was deepened to the Pennsylvanian series, probably the Ingleside formation, but no deeper production was found. A third well was dry. The field is disappointing to date.

The Little Buffalo Basin field, in which gas was discovered in the Frontier formation in 1914, was drilled to the Embar and Tensleep formations. The Good-

stein well was completed to produce from the Tensleep sandstone, topped at 4,780 feet, for an initial production of 150 barrels per day of 20.2° A.P.I. gravity oil. The Stanolind well, 4 miles northwest, was drilling in the Tensleep sandstone at the end of the year, and later was abandoned at 5,944 feet in the Madison limestone. According to the Frontier contour map, the Stanolind well should have been about 270 feet higher structurally than the Goodstein well. The drilling revealed that it was only 115 feet higher on the Frontier, and was 181 feet lower on the Tensleep.

The Kirk Oil Company completed a well in the Madison limestone at Frannie in the north fault block, which was in a zone about 100 feet lower than the only previous Madison producer, a well drilled by Stanolind Oil and Gas Company in 1929 in the southern fault block. Two wells which are structurally lower found water in the Madison and were plugged back to the Tensleep sandstone. The productive areas of the Madison limestone around the producers appear to be very limited.

Three wells were drilled to the Madison limestone at South Oregon Basin, the Yale Oil Corporation making the first discovery. The only previous Madison well, an edge well drilled in 1928, was unsuccessful. After testing and proving the Madison (17.5° A.P.I. gravity oil), the wells were plugged back to produce from the Embar formation so as to preserve the spacing pattern for that zone and avoid offset and royalty complications. At North Oregon Basin, three wells drilled to the Madison went to water, and were plugged back. The presence of producible amounts of Madison oil is questionable. A down-structure well drilled in 1928 reported good oil showings.

Unsuccessful tests of deeper zones in fields that produce from some shallower formation include those at White River, Colorado; Devon, Pondera, and Conrad-Midway, Montana; and Maverick Springs, Horse Creek, South Baxter Basin, North LaBarge, East Mahoney, Bunker Hill, Lance Creek, Dewey, and North Oregon Basin, Wyoming.

EXTENSIONS

Montana.—In the Kevin-Sunburst field, a well in the NW. $\frac{1}{4}$, NE. $\frac{1}{4}$ Sec. 2, T. 36 N., R. 3 W., was completed in December, 1943, for an initial production of 85 barrels of 44.9° A.P.I. gravity oil from a sand in the Ellis formation, confirming the existence of a pool discovered in 1941 but not developed. The area has been named the Thorpe pool. Two oil wells were completed in the Madison limestone by The Texas Company in Sec. 2, T. 34 N., R. 3 W., $\frac{1}{2}$ – $\frac{3}{4}$ mile northwest of old wells producing gas from the Sunburst sand. These wells are about $2\frac{1}{2}$ miles from the nearest oil wells to the east, north, and northwest.

Development was active at the south end of the Cut Bank field, but the only new section added to the producing area was Sec. 32, T. 32 N., R. 5 W.

The Marias River gas area was discovered in 1940 by the Nadeau Brothers shallow well in Sec. 16, T. 31 N., R. 3 W. In 1943 gas wells were completed about 2, 3, and 4 miles northeast of the discovery well, and the field began furnishing gas to Shelby.

In 1942, the R. C. Tarrant DeStaffany well in the NW. $\frac{1}{4}$, NE. $\frac{1}{4}$ Sec. 30, T. 28 N., R. 1 W., was completed as a small oil producer in the Conrad-Midway field, but it was suspended during 1943. The Tarrant Wood well in the NE. $\frac{1}{4}$, NW. $\frac{1}{4}$ Sec. 32, was continued to 3,695 feet in the Devonian in 1943, and suspended. A new well, drilled by Hagemann and Pond in the SE. $\frac{1}{4}$, NW. $\frac{1}{4}$ Sec. 20, was completed as an oil well in September, 1943, with a reported initial production of 27 barrels per day of 42.6° A.P.I. gravity oil in the Sunburst sand at 1,736-1,766 feet. Three dry holes also were drilled in this area, one of which was only $\frac{1}{4}$ mile west of the new oil well.

Wyoming.—The greatest extension and development was in the Elk Basin field, which extends across the line into Montana. This field has been the subject of several press and periodical releases, and is said to have contributed the largest new oil reserve of any field in the United States in 1943. The Tensleep discovery well finished drilling on November 19, 1942, and the second new well was started on February 19, 1943. At the end of the year, 25 oil wells had been completed, and about 5,800 acres had been proved productive. The surface elevations of the wells vary from about 4,400 to 5,000 feet, and the top of the Tensleep sandstone in the productive wells has a sea-level elevation varying from plus 656 to minus 855 feet. Only one well was unsuccessful, a step-out well with a minus 1,718 elevation on the Tensleep sandstone, about $\frac{3}{4}$ mile southwest of the nearest producer.

The Tensleep productive area in the Lost Soldier field was blocked out by completions to the northwest and southwest, although structurally, these wells were higher on the Tensleep sandstone than a late 1942 completion. The surface elevation of this field is about 6,900 feet, and the oil wells have sea-level elevations ranging from plus 3,047 to plus 1,591 feet on the top of the Tensleep. The low well is only 1,600 feet southeast of the high well. About 1,300 acres are estimated to be proved in the Tensleep sandstone, which is more than twice the area developed in the shallow sands since 1917. The field had 14 Tensleep oil wells and no dry holes at the end of 1943.

The "high" of the Wertz field is about 2 miles east and $\frac{1}{2}$ mile north of that of the Lost Soldier field, and well elevations vary from about 6,700 to 7,000 feet. Wells close to the productive limits were completed at the northwest and southeast ends of the dome in 1943, outlining a productive area of about 650 acres. The oil wells have sea-level elevations ranging from plus 681 to plus 1,151 on the top of the Tensleep sandstone, with 23 wells completed. One dry hole was drilled several hundred feet down the structure on the southwest flank.

All the drilling in the Oregon Basin field was within the known structural productive limits, except for the Kirk Oil Company's well in the south fault block of South Oregon Basin. This well is about $1\frac{1}{4}$ miles south of the nearest producer, but whether the intervening land will be productive or whether it is a separate pool, can not be determined yet. This block has produced gas from the Frontier formation, but was not tested deeper until 1943. The well was completed in the Embar formation, the underlying Tensleep sandstone carrying water.

IMPORTANT WILDCATS

Because of the increased activity and interest in the region, and the large number of exploratory wells, Table III has been prepared to list and show pertinent data about 123 wildcat and semi-wildcat wells. Wells less than 1,500 feet deep are not included, which reduces the size of the list about one third, without omitting wells of much importance except a few shallower wells at Big Piney and Marias River and a few wells started late in the year.

In selecting these wells, the writer does not wish to enter into the debatable question as to what is a wildcat, an especially difficult question in the Rocky Mountain region where there are multiple zones and where structural conditions are sometimes unknown or vary greatly within short distances. The wells listed are a mile or more from any other producer, are tests of deeper formations, thus ranking as semi-wildcat, at least, or are out-and-out wildcats. The distances between the Gage, Montana, and some other wells have been cited previously. As another example, one well at Elk Basin in Montana and one in Wyoming have been included. The Montana well is $2\frac{3}{4}$ miles north and 1 mile west of the 1942 discovery well, is outside of the Frontier productive limits, and was the third new well started, so thus is a pure wildcat according to some definitions. The Wyoming well selected is more than one mile southwest of the discovery well, is also one of the first Tensleep wells, and is the lowest structurally of any oil well drilled during the year.

GEOPHYSICAL PROSPECTING

The following geophysical work was reported.

Colorado.—Ohio Oil Company, seismograph in Morgan and Weld counties; Kerlyn Oil Company, seismograph in Boulder, Morgan, and Weld counties; California Company, gravimeter in Moffat and Morgan counties; Stanolind Oil and Gas Company, gravimeter in Moffat County; Phillips Petroleum Company, gravimeter in Baca and LaJunta counties.

Montana.—Carter Oil Company, core-drilling in Liberty and Pondera counties; General Petroleum Company, seismograph in Teton County; Texas Company, seismograph in Toole County.

South Dakota.—Amerada Petroleum Corporation, seismograph and gravimeter in Fall River County.

Wyoming.—Amerada Petroleum Corporation, seismograph in Johnson County; Barnsdall Oil Corporation, gravimeter in Campbell County; British American Oil Producing Company, seismograph in Carbon and Fremont counties; California Company, gravimeter in Carbon County; Carter Oil Company, gravimeter in Hot Springs, Park and Washakie counties, core-drill in Campbell county, seismograph in Campbell, Converse, Goshen, and Park counties; Continental Oil Company, gravimeter in Big Horn and Johnson counties, seismograph in Carbon, Park, and Platte counties; General Petroleum Corporation, seismograph in Carbon, Natrona, and Washakie counties; Gulf Oil Corporation, gravimeter and seismograph in Campbell County; Kerlyn Oil Company, seismo-

graph in Carbon, Fremont, and Natrona counties; Pure Oil Company, seismograph in Washakie County; Shell Oil Company, gravimeter and seismograph in Converse County; Sinclair Wyoming Oil Company, seismograph in Carbon, Fremont, Johnson, and Natrona counties; Stanolind Oil and Gas Company, seismograph in Fremont and Goshen counties; gravimeter in Carbon and Lincoln counties; Superior Oil Company, gravimeter in Campbell, Natrona, and Weston counties; Texas Company, seismograph in Johnson and Sheridan counties.

So far as known to the writer, geophysical prospecting was not responsible for any of the discoveries of 1943, although it may be credited with assistance. In fact, well locations on the blocks covered by the preceding list have not yet been announced.

GENERAL

Interest in the Rocky Mountain region was very active. A number of companies new to the region had geological or geophysical crews at work, established offices, drilled wells or acquired properties.

In Colorado, the Phillips Petroleum Company opened an office at Denver, and the Gulf Oil Corporation at Golden. In Montana, the Barnsdall Oil Corporation, the Carter Oil Company, the Gulf Oil Corporation, the Pure Oil Company and the Shell Oil Company are located at Billings; and the British-American Oil Producing Company and the Shell Oil Company at Great Falls. In Wyoming, the Cities Service Oil Company, the Continental Oil Company, the Pacific Western Oil Company, the Shell Oil Company, and the Texas Company are newcomers in Casper.

The Union Oil Company purchased the properties and refinery of the Glacier Production Company at Cut Bank. The Carter Oil Company purchased the Santa Rita Oil and Gas Company, the Northwestern Refining Company, the Minnelusa Oil Corporation, the Yale Oil Corporation, and other properties. The Barnsdall Oil Corporation was said to have purchased half interest in the Husky Refining Company. The Continental Oil Company purchased the Goodstein properties at Elk Basin. The Texas Company took over the remaining properties of the Ohio Oil Company at Kevin-Sunburst, which practically removes Ohio from Montana, except in the Dry Creek field. The Texas Company also purchased Continental leases at Kevin-Sunburst, and sold its leases at Pondera to Ralph Desamone of Seattle.

Several lease sales of Government and Indian land attracted attention. In two sales at Elk Basin, 338 acres commanded total bonuses of \$2,022,984 to establish a new record. Prices varied from \$3,600 an acre for one 45-acre block to \$26,216 for a 1.11-acre tract needed to complete a drilling unit. Eighty acres at Lost Soldier sold for \$80,000 and 1,191 acres at Little Buffalo Basin for \$650,224, at \$225-\$1,150 per acre. The largest sale, with the smallest bonus, was 28,956 acres of gas land at Bowdoin, for which \$2,712, at 5 to 40 cents per acre, was bid.

Exploratory activities in 1944 should be very active, if lease blocks are completed and men and material permit.

DEVELOPMENTS IN SOUTHEASTERN UNITED STATES IN 1943¹

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ABSTRACT

The year 1943 was the most important in the history of development in the southeastern United States: five new fields were discovered, four in Mississippi and one in Florida; of first importance, however, was the promise of new large reserves reaching along the Gulf Coast from the Mississippi River to the tip of peninsular Florida.

INTRODUCTION

The area covered in this report comprises the states of Mississippi, Alabama, Georgia, and Florida. Other states in this geographic province are not mentioned, due to their relative lack of importance at the present time.

The year was outstanding in the history of the development in the southeast, the principal events being the following.

1. The discovery of four new fields in Mississippi.
2. The extension of the proved productive area from the west to the east boundary of Mississippi and south into the Mississippi salt basin.
3. The discovery of production in the south part of peninsular Florida.
4. The addition of four new producing formations.
5. The most important event was the addition of a new large area with a great volume of sediments capable of furnishing reserves for many years to come; this area reaches along the Gulf Coast from the Mississippi River to the south tip of Florida.

DEVELOPMENT

During the year, there was a decided upturn in drilling operations. Compared with 57 dry holes and 12 producers drilled in 1942, 124 wells were drilled, of which 92 were dry and 32 producers. The distribution of these wells is shown in Table I.

TABLE I

State	Wildcat Dry	Wildcat Producers	Field Wells
Mississippi	77	4	27
Alabama	8	0	0
Georgia	2	0	0
Florida	5	1	0

Production showed a decline from the previous year, dropping from a total of 28,616,509 barrels in 1942, to 18,779,420 barrels in 1943. This decrease was due to the decline in production in the Tinsley field, Yazoo County, Mississippi. The downward trend was not offset by an increase of 1,147,262 barrels at Pickens, Yazoo County, Mississippi, and the small increase due to new discoveries, which were not developed sufficiently to influence appreciably current figures.

¹ Read by title before the Association at Dallas, March 22-23, 1944. Manuscript received, April 20, 1944.

² Consulting geologist.

TABLE II
MISSISSIPPI

<i>Field</i>	<i>No. Wells</i>	<i>Production</i>	<i>Runs</i>	<i>Cumulative</i>
Tinsley	336	17,264,156	17,272,845	65,046,178
Pickens	33	1,458,651	1,451,073	2,392,483
Brookhaven	1	16,711	16,306	9,234
Cary	2	19,987	26,830	30,987
Cranfield	1	12,891	11,921	12,891
Eucutta	1	1,663	672	1,663
Flora	1	4,333	3,660	4,714
Carthage Point	1	379	379	379
Total Mississippi	377	18,779,423	18,783,706	67,505,509
Sunniland (Florida)	1	6,140*	—	6,140
Area total	378	18,785,563		67,511,649

* Includes January, 1944.

Table II gives a summary of 1943 production, in barrels.

FIELDS DISCOVERED

Five new fields were discovered: Flora, Eucutta, Brookhaven, and Cranfield are in Mississippi; Sunniland is in Collier County, Florida.

The Flora field was opened by the Love Petroleum Company's Anderson No. 1, Sec. 12, T. 8 N., R. 1 W., Madison County, Mississippi. The structure was found by the Union Producing Company in 1938 by seismic methods and the block was leased during the latter part of 1938 and January, 1939.

The first well drilled in the area was the Union Producing Company's Anderson A-1; it was completed in May, 1939, and was abandoned after making some oil and salt water on a drill-stem test. The discovery well was drilled on leases farmed out to the Love Petroleum Company. Oil is produced from the first porosity in the gas rock of Selma age.

No prediction about the possibilities of this field is possible as most of the area likely to produce is under the Mississippi Ordnance Plant and development must wait for the end of the war.

The Eucutta field was discovered by the Gulf Refining Company's Aden Davis, Sec. 2, T. 9 N., R. 9 W., Wayne County. This feature was first mapped on the surface in 1930 by Paul J. Fly and was immediately leased by the Humble Oil and Refining Company. After paying rentals for several years the company dropped the block.

The Gulf Research Corporation found a gravity anomaly in the same general area in 1937 and the Gulf Refining Company leased it in the same year. At a later date the Gulf Research Corporation re-surveyed the area, using seismic methods. Oil was produced from the Massive sand of lower Tuscaloosa age.

The Brookhaven field was opened by the California Company's Smith No. 1, Sec. 4, T. 7 N., R. 7 E., Lincoln County, Mississippi. This area was discovered by seismic work during 1938 and the block was leased during the same year. In 1940 the block was re-shot. Drilling was commenced in 1942. Oil is produced from the basal sand of lower Tuscaloosa age.

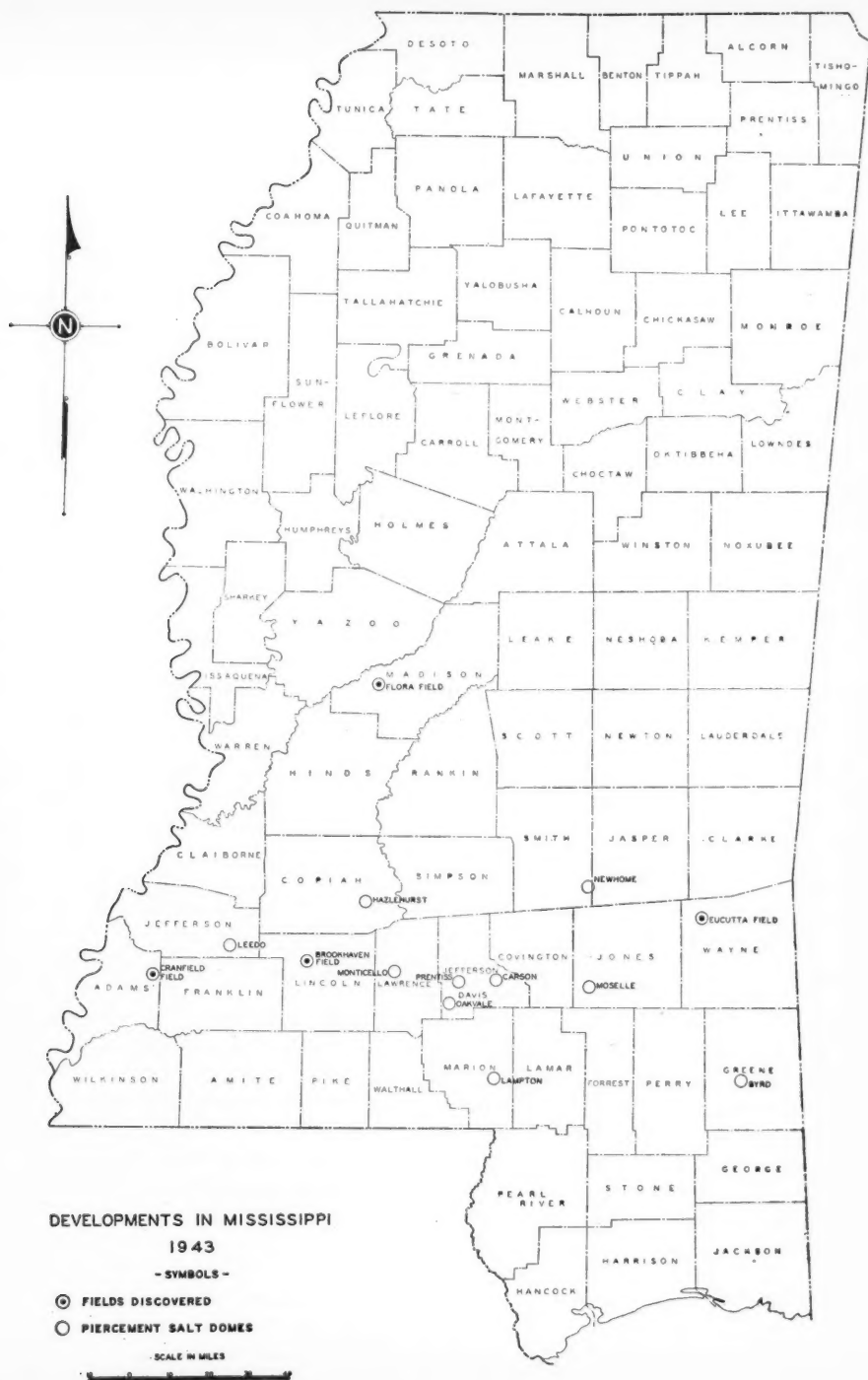


FIG. 1

The Cranfield field was leased in 1941 and shot during the following year. The discovery well was the California Company's National Gasoline Company of Louisiana No. 1, Sec. 52, T. 7 N., R. 1 W., Adams County, Mississippi. Oil was produced from the Wilcox formation.

Probably the most significant discovery of the year insofar as future reserves are concerned, was the Humble Oil and Refining Company's Gulf Coast Realty Company's No. 1, Sec. 30, T. 48 S., R. 30 E., Sunniland field, Collier County, Florida.

This area was first taken under contract by the Gulf Refining Company in 1937. Both gravity and seismic surveys were run in 1938, after which the block was dropped.

In 1941 the Humble Oil and Refining Company acquired the block. The exploratory methods used were gravity meter, followed by core drilling.

Oil is produced from a cavernous limestone from 11,613 to 11,626 feet. The producing formation is definitely Lower Cretaceous, probably Glen Rose.

PIERCEMENT SALT DOMES

Ten piercement-type salt domes were discovered. Table III gives all pertinent data including names adopted by the nomenclature committee of the Mississippi Geological Society.

TABLE III

<i>Name</i>	<i>Company</i>	<i>County</i>	<i>Location</i>	<i>Date Top Cap (Feet)</i>	
Hazelhurst	Freeport Sulphur	Copiah	29-10N-9E	5-14	1,483
Leedo	Gulf Refg. Co.	Jefferson	19-8N-4E	6-29	1,359
Lampton	Gulf Refg. Co.	Marion	20-3N-17E	6-25	1,365
Byrd	Gulf Refg. Co.	Greene	16-3N-7W	7-21	1,720?
Prentiss	Gulf Refg. Co.	Jefferson Davis	25-7N-19W	8-8	2,553
Newhome	Gulf Refg. Co.	Smith	5-10N-13W	8-4	1,830
Carson	Gulf Refg. Co.	Jefferson Davis	19-7N-17W	9-4	2,318
Monticello	Gulf Refg. Co.	Lawrence	35-7N-10E	9-25	2,256
Oakvale	Freeport Sulphur	Jefferson Davis	32-6N-19E	10-27	1,894
Moselle	Gulf Refg. Co.	Jones	31-7N-13W	11-6	2,120

Four new producing formations were added during the year, namely, (1) Wilcox formation of Eocene age; (2) massive lower Tuscaloosa sand of Upper Cretaceous age; (3) basal Tuscaloosa sand of Upper Cretaceous age; and (4) Glen Rose formation of Lower Cretaceous age.

The finding of oil in the Glen Rose is especially important in its bearing on future reserve prospects. High-gravity oil was discovered in the Brookhaven field, Lincoln County, Mississippi, in several sands, ranging from 10,300 feet to 12,000 feet. The Humble Oil and Refining Company found a good showing of high-gravity oil in its Hurst well in Greene County, Mississippi. The Humble Oil and Refining Company is producing 19° gravity oil from probable Glen Rose in the Sunniland field, Collier County, Florida. These widely separated showings suggest the possibilities of oil in the Lower Cretaceous and especially the Glen Rose formation.

IMPORTANT WILDCATS

In addition to the wells which opened new fields, Table IV gives data on other important wildcats.

TABLE IV
MISSISSIPPI

<i>County</i>	<i>Location</i>	<i>Company</i>	<i>Total Depth (Feet)</i>	<i>Formation Reached</i>
Adams	1-6N-4W	Pure Oil Co.	11,102	Glen Rose
Claiborne	66-11N-2E	Amerada Petrol. Corp.	9,899	Glen Rose
Hinds	14-5N-2W	Plains Prod. Co.	7,555	Paluxy
Hinds	29-6N-3W	Pure Oil Co.	9,001	Lower Cretaceous
Jackson	20-5S-8W	Humble O. & R. Co.	11,378	Glen Rose
Lawrence	28-5N-11E	William Helis	11,444	Glen Rose
Madison	19-9N-1E	Love Petrol. Co.	9,007	Paluxy
Neshoba	1-9N-11E	Sou. Natural Gas	6,876	Smackover
Newton	28-5N-13E	Sun Oil Co.	10,117	Smackover
Simpson	8-2N-4E	Gulf Refg. Co.	9,500	Paluxy
Stone	10-4S-10W	R. W. Norton, Jr.	8,348	Tuscaloosa
Stone	30-2S-12W	Harry I. Morgan	8,515	Tuscaloosa
Wayne	2-6N-7W	Humble O. & R.	8,566	Glen Rose

ALABAMA

Choctaw	36-11N-5E	H. L. Hunt	5,942	Tuscaloosa
Monroe	28-7N-5E	James L. Duffy	5,562	Lower Cretaceous
Tuscaloosa	2-18S-9W	Stanolind Oil & G.	5,410	Ordovician

EXPLORATORY METHODS AND RESULTS

The salt basin of south-central Mississippi and adjacent Alabama offers an excellent example of successful use of the gravity method of exploration. Among geophysical reconnaissance methods, it has given highly satisfactory results. Sufficient drilling has not been done to make any comparison of results of different methods but there is some suggestion that gravity results are more accurate than once expected. At present only outstanding features of this type have been drilled; during the coming years minor features remain to be evaluated. Table V gives a summary of exploration activity.

TABLE V

<i>Type Work</i>	<i>Parties in Jan.</i>	<i>Parties in June</i>	<i>Parties in Dec.</i>
Seismic	12	14	32
Gravity	9	8	19
Magnetic	1	1	3
Soil analysis	0	0	0
Core drills	5	2	2
Surface	4	4	4

DEVELOPMENT TRENDS

The following trends in exploration and development are worthy of note.

1. Unusual success in use of gravity methods in Mississippi and Alabama, especially in the salt basin.
2. Gain in accuracy of seismic work.
3. The coming of age of the play in Mississippi as an oil-producing state and the eastward movement of the pioneer type of activity.
4. Continued exploration in Mississippi on a well rounded basis by use of seismograph and gravity meter, as well as surface and subsurface geology.
5. Continued leasing and geophysical programs in Alabama.
6. Leasing of large blocks in southern Georgia and in Florida with an exploration program under way in the latter.

DEVELOPMENTS IN WEST TEXAS AND SOUTHEASTERN NEW MEXICO IN 1943¹

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ABSTRACT

The West Texas-southeastern New Mexico district includes 46 counties in West Texas and 6 counties in southeastern New Mexico, and includes the following features: East platform, Midland basin, Central Basin platform, Delaware basin, South plains, and a part of the Edwards plateau.

A regional map shows new discoveries, important exploratory drilling wells and their relationship to existing fields. Tables list all fields of the district, including names, locations, and producing formations in the 142 pools in West Texas and 52 in southeastern New Mexico. The totals of 902 wells drilled in West Texas and 260 in New Mexico in 1943 are comparable with the totals of 1,320 and 339, respectively, in 1942, and were the lowest totals during the past 6 years. The drop in total completions was somewhat offset by a decided expansion of deeper drilling. The 111 West Texas wildcats resulted in 17 new discoveries, representing a success of 15.32 per cent, while in New Mexico 37 wildcats found 6 new pools representing 16.22 per cent exploratory success. Total pipe-line runs in West Texas of 98,070,000 barrels were 17,040,000 barrels more than in 1942, while in New Mexico total runs of 38,047,000 exceeded those of 1942 by 6,550,000 barrels.

Active drilling operations per week for West Texas averaged 210 of which 37 were exploratory, while in New Mexico of 79 wells, 21 were exploratory. The lowest development rate was in January, and the highest in December. This upswing in drilling was largely the result of rearrangement of present pipe lines plus prospects for a decided increase of outlet capacity by two major pipe lines under construction to the Mid-Continent and eastern markets plus response on the part of the industry to the vital war demands for increased production of oil.

Of 17 new discoveries in West Texas only 9 were of outstanding importance: 4 were Ellenburger finds, 1 Silurian, 3 in the deep Permian, and only 1 in the upper Permian. This distribution reflects the results of deeper drilling which featured the year's activity and gave the Central Basin platform added prominence in respect to Permian and pre-Permian reserves.

A large flow of gas encountered in Devonian chert in an exploratory well in Winkler County furnished the only new productive zone discovered in the district.

Major extensions involved the northern part of the Slaughter pool in Cochran and Hockley counties, Fullerton and Embar pools in Andrews County, and the Barnhart field in Reagan County. There was no important extension in New Mexico.

Of the 111 wildcats drilled in West Texas, the 54 of outstanding importance included 15 which tested the Ellenburger (Ordovician), and an equal number the Clear Fork (Permian). At the close of the year there were 45 important wildcats drilling in West Texas and 10 in southeastern New Mexico.

Geophysical crews of all types in West Texas increased from 25 units in January to 35 in December; of these, seismographs and gravimeters predominated with 20 units and 11 units, respectively, at the close of the year. A total of 6 units in New Mexico reflected no increase during the period. The trend of geophysical operations was definitely toward mapping of the deeper formations and expansion into frontier areas.

No proposed change in the nomenclature was advanced during the year. The Lovington sand of the San Andres formation (Permian) and the Cañas and Joyita members of the Yeso formation (Permian) were described and defined.

The trend in exploration and development was definitely toward deeper testing of the lower Permian and exploration of the pre-Permian, particularly the Ellenburger.

Fifteen geological and development papers were published.

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INTRODUCTION

The West Texas-southeastern New Mexico district includes 46 counties in West Texas and 6 counties in southeastern New Mexico. It is bounded on the north by the Texas panhandle; the most northern counties include Bailey, Lamb, Hale, and Floyd. The Rio Grande River forms the south and southwest boundary. The New Mexico counties of Chaves, DeBaca, Curry, and Roosevelt form the northwest part. The east boundary, which joins the west-central Texas district, extends from northwest Motley County south to Real County where it connects with the South Texas district. It extends from 30° to 34° N. Lat. and from 100° to 105° W. Long., and comprises approximately 100,000 square miles.

The major features include the Eastern platform, Midland basin, Central Basin platform, Delaware basin, South plains, and west and northwest parts of the Edwards plateau.

A considerable part of the data comprising this paper is presented in tables and graphs, this being a partial change from the method of previous years. This means has been suggested by the publication committee, and it is hoped that it will, in addition to saving space, furnish all of the essential data in a more readily located and usable form.

TABLE I
PRODUCING FIELDS, WEST TEXAS*
December 31, 1943

<i>Map Co'Ord.</i>	<i>Field Name</i>	<i>County</i>	<i>Producing Formation</i>	<i>Age</i>
G-5	Abell	Pecos	Simpson and Ellenburger	Ordovician
G-5	Abell Permian	Pecos	San Andres, Clear Fork and Wichita	Permian
†G-4	Apco 1600	Pecos	Queen	Permian
G-4	Apco Warner	Pecos	Ellenburger	Ordovician
L-4	Barnhart	Reagan	Ellenburger	Ordovician
K-4	Big Lake	Reagan	Queen, San Andres, Clear Fork and Ellenburger	Permian, Or- dovician
F-5	Byrd	Ward	Yates	Permian
I-12	Cedar Lake	Gaines	San Andres	"
E-3	Chancellor	Pecos	Delaware Mountain	"
†H-8	Clabberhill	Andrews	Holt, San Andres (?)	"
K-2	Clara Couch	Crockett	Grayburg and San Andres	"
I-5	Cowden, Crane	Crane	Grayburg	"
H-8	Cowden, North	Ector	Grayburg and San Andres	"
H-8	Cowden, North Deep	Ector	Holt, San Andres	"
H-7	Cowden, South	Ector	Grayburg	"
J-4	Crockett	Crockett	Grayburg	"
G-15	Dean	Cochran	San Andres	"
G-9	Deep Rock	Andrews	San Andres	"
G-5	Dobbs	Ward	Queen	"
H-6	Dunes	Crane	Grayburg	"
E-8	Eaves	Winkler	Yates and Seven Rivers	"
H-6	Edwards	Crane	Grayburg	"
G-8, 9	Embar Ellenburger	Andrews	Ellenburger	Ordovician
G-8	Embar Permian	Andrews	Tubbs, Clear Fork	Permian
G, H-8	Emma	Andrews	San Andres	"
F-7	Emperor	Winkler	Yates and Seven Rivers	"
F-7	Emperor (Deep)	Winkler	Seven Rivers	"
F-5, 6	Estes	Ward	Yates and Seven Rivers	"
H-7	Foster	Ector	Grayburg and San Andres	"

TABLE I—Continued

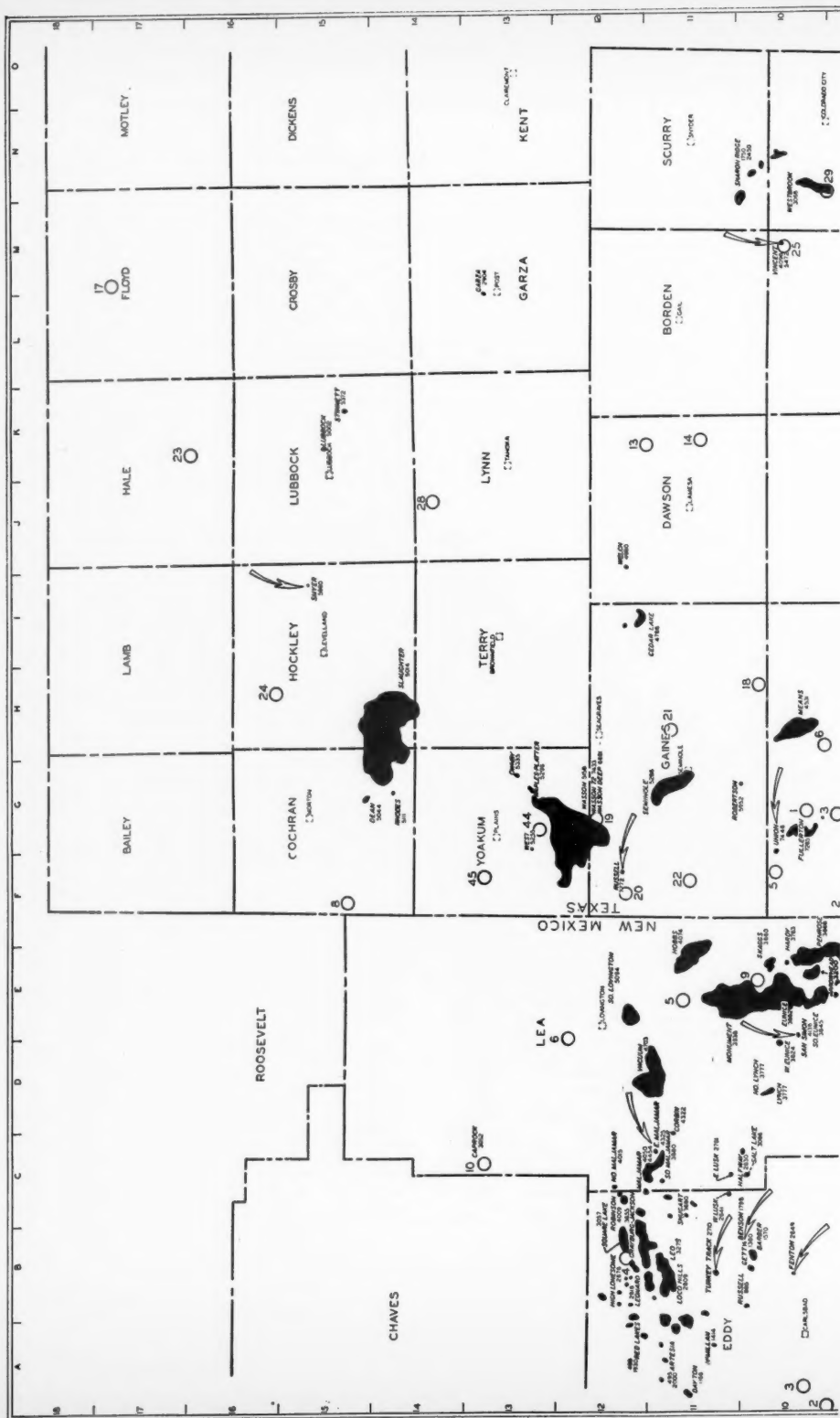
<i>Map Co'Ord.</i>	<i>Field Name</i>	<i>County</i>	<i>Producing Formation</i>	<i>Age</i>
G-4	Fromme	Pecos	Queen	Permian
G-9	Fuhrman	Andrews	San Andres	"
G-10	Fullerton	Andrews	Clear Fork, Deep	"
N-6	Funk	Tom Green	San Andres ?	"
L-13	Garza	Garza	San Andres	"
G-8	Goldsmith	Ector	Grayburg and San Andres	"
G-8	Goldsmith, North	Ector	San Andres	"
K-4	Grayson	Reagan	San Andres	"
F-7	Halley	Winkler	Yates and Seven Rivers	"
F-7	Halley Extension	Winkler	Yates and Seven Rivers	"
H-7	Harper	Ector	San Andres	"
G-4	Heiner	Pecos	Ellenburger	Ordovician
E-7	Henderson	Winkler	Yates and Seven Rivers	Permian
E, F-7, 8	Hendrick	Winkler	Yates and Seven Rivers	"
I-4	Herrington	Upton	Grayburg	"
3-K	Hoover	Crockett	Queen	"
L, M-8	Howard-Glasscock	Howard and Glasscock	Yates, Seven Rivers, Grayburg, San Andres and Clear Fork	"
I-4	Hurdle	Upton	Grayburg	"
M-9	Iatan-East Howard	Howard	Clear Fork	"
M-9	Iatan, North	Howard	Clear Fork	"
N-4	Irion	Irion	San Angelo	"
G-5	Jamison Pollard	Pecos	Seven Rivers	"
H-8	Johnson	Ector	Grayburg	"
H-6	Jordan	Ector	Grayburg, San Andres	"
F-7, 8	Kermit	Winkler	Yates and Seven Rivers	"
†F-7, 8	Kermit Ellenburger	Winkler	Ellenburger	Ordovician
F-7, 8	Keystone Colby	Winkler	Grayburg	Permian
F-7, 8	Keystone Lime	Winkler	Grayburg, San Andres	"
†F-7, 8	Keystone Ellenburger	Winkler	Ellenburger	Ordovician
†F-7, 8	Keystone Holt	Winkler	Holt and San Andres	Permian
K-3	Live Oak	Crockett	San Andres	"
E-8	Leck	Winkler	Yates and Seven Rivers	"
G-4	Lehn	Pecos	Queen	"
K-15	Lubbock	Lubbock	Clear Fork	"
†I-9	Mabee	Andrews	Grayburg	"
F-6	Magnolia Sealy	Ward	Yates and Seven Rivers	"
F-6	Magnolia Sealy South	Ward	Yates and Seven Rivers	"
G-9	Mascho	Andrews	Grayburg and San Andres	"
G-8	Mason	Loving	Delaware Mountain	"
G-4	Masterson	Pecos	Queen	"
†G-4	Masterson 3500	Pecos	Tubbs, Clear Fork	"
†H-4	McCandless	Pecos	Ellenburger	Ordovician
I-4	McCamey	Upton	Grayburg, San Andres	"
I-5	McElroy	Crane, Upton	Grayburg	"
G-5	McKee	Crane	Simpson	"
H-10	Means	Andrews	San Andres	Permian
G-6	Monahans	Ward	Ellenburger	Ordovician
G-6	Monahans Permian	Ward	Tubbs, Clear Fork	Permian
D-6	Monroe	Ward	Delaware Mountain	"
L-9	Moore	Howard	Grayburg	"
†H-3	Mule Creek	Pecos	Queen	"
F-5	Netterville	Pecos	Yates	"
K-3	Noelke	Crockett	Seven Rivers	"
K-3	Olson	Crockett	Grayburg	"
G-13	Ownby	Yoakum	San Andres	"
P-3	Page	Schleicher	Strawn	Pennsylvanian
H-9	Parker	Andrews	San Andres	Permian
F-5	Payton	Ward	Yates	"
G-4	Pecos Valley (HG)	Pecos	Yates	"

TABLE I—Continued

<i>Map Co'Ord.</i>	<i>Field Name</i>	<i>County</i>	<i>Producing Formation</i>	<i>Age</i>
G-4	Pecos Valley (LG)	Pecos	Yates	Permian
H-7	Penwell	Ector	San Andres	"
D-6	Pruitt	Ward	Delaware Mountain	"
F-6	Pyote	Ward	Yates	"
G-14	Rhodes	Cochran	San Andres	"
F-3	Richards	Pecos	Dewey Lake	"
G-10	Robertson	Gaines	Holt, San Andres	"
†F-12	Russell	Gaines	Lower Clear Fork	"
G-5, 6	Sand Hills Ordovician	Crane	Simpson and Ellenburger	Ordovician
G-5, 6	Sand Hills Permian	Crane	Tubbs, Clear Fork	Permian
†G-6	Sand Hills West	Crane	Holt, San Andres	"
E-8	Scharborough	Winkler	Yates	"
G-11	Seminole	Gaines	San Andres	"
L-3	Shannon	Crockett	Grayburg	"
M-10	Sharon Ridge	Scurry	San Andres, San Angelo and Clear Fork	"
G-4	Shearer	Pecos	Seven Rivers and Queen	"
G-5	Shipley	Ward	Queen	"
G-5	Shipley (Silurian)	Ward	Silurian	Silurian
K-2	Simpson	Crockett	Grayburg	Permian
H-14	Slaughter	Cochran and Hockley	San Andres	"
†I-15	Smyer	Hockley	Clear Fork	"
M-9	Snyder	Howard	San Angelo and Clear Fork	"
F-6	Spencer	Ward	Yates	"
K-15	Stinnett	Lubbock	Clear Fork	"
I-3	Taylor Link	Pecos	Yates, Queen and San Andres	"
J-3	Toborg	Pecos	Toborg	Cretaceous
L-3	Todd Deep	Crockett	Crinoidal (Strawn)	Pennsylvanian
†I-4	McCamey-Silurian	Upton	Silurian	Silurian
†F-10	Union	Andrews	Lower Clear Fork	Permian
†M-13	Vincent	Howard	Clear Fork	"
H-6	Waddell	Crane	Grayburg	"
H-6	Waddell, Ella	Crane	Grayburg	"
I-3	Walker	Pecos	Queen	"
G-13	Waples Platter	Yoakum	San Andres	"
F-6	Ward, North	Ward	Yates	"
F-5	Ward, South	Ward	Yates, Seven Rivers and Queen	"
F, G-12, 13	Wasson	Yoakum	San Andres	"
G-12	Wasson (Deep 6800)	Yoakum	Lower Clear Fork	"
G-12	Wasson 72	Yoakum	Clear Fork ?	"
I-4	Webb Ray	Upton	Grayburg	"
F-7	Weiner	Winkler	Queen	"
J-12	Welch	Dawson	San Andres	"
H-3	Wentz	Pecos	Ellenburger	Ordovician
F-13	West	Yoakum	San Andres	Permian
G-9	West Andrews	Andrews	Grayburg and San Andres	"
N-10	Westbrook	Mitchell	Clear Fork	"
D-7	Wheat	Loving	Delaware Mountain	"
†G-7	Wheeler Ellenburger	Winkler	Ellenburger	Ordovician
I-3	White and Baker	Pecos	Queen	Permian
I-3	White and Baker Lime	Pecos	Grayburg	"
L-3	World	Crockett	Grayburg	"
L-3	Wyatt	Crockett	San Andres	"
J-3	Yates	Pecos	San Andres	"
J-3	Yates Smith Sand	Pecos	Yates	"

* Fields listed by Oil and Gas Division of the Texas Railroad Commission, December, 1943.

† 1943 discoveries.



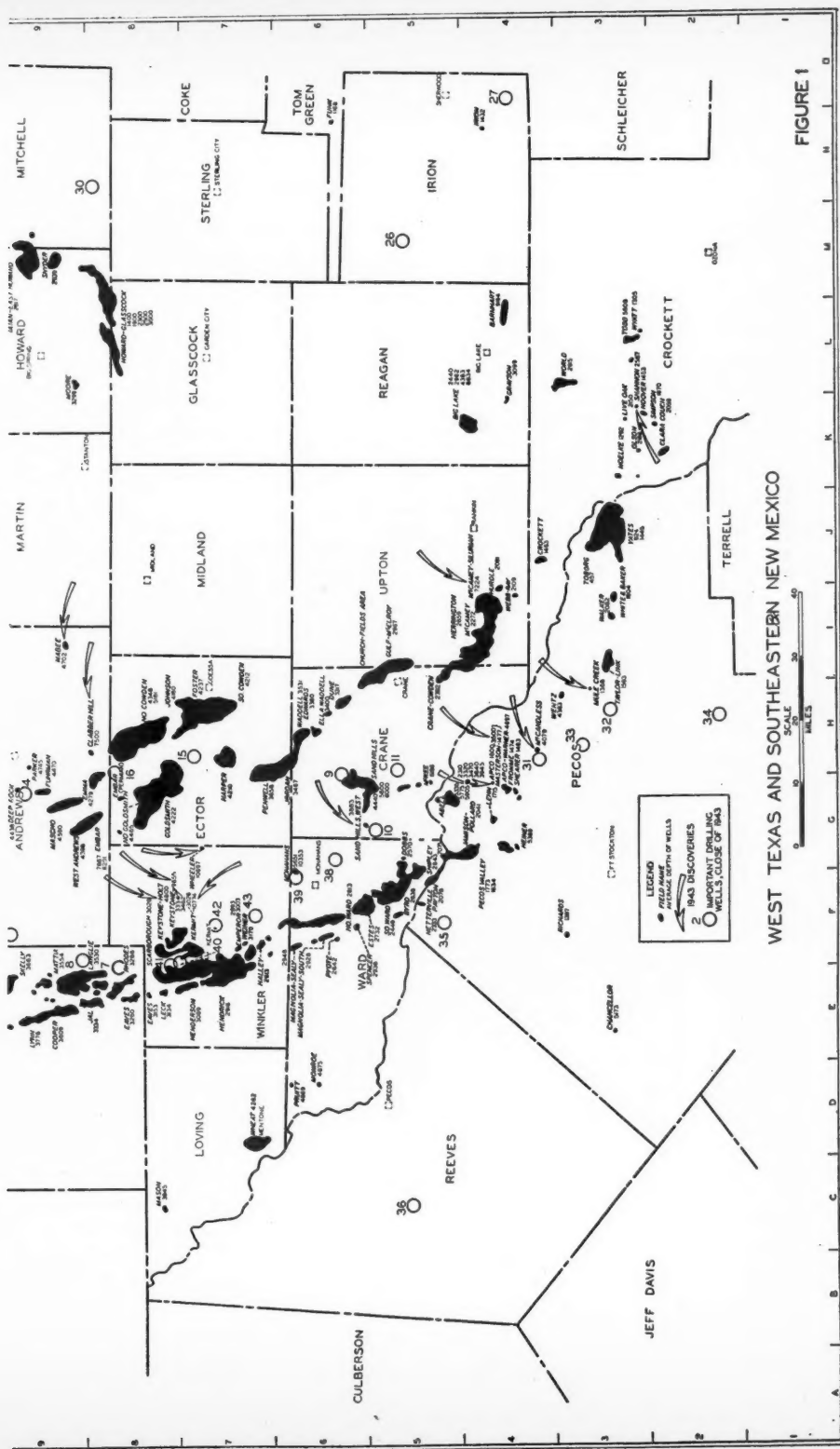


TABLE II
FIELDS OF SOUTHWEST NEW MEXICO
December 31, 1943

<i>Map Co'Ord.</i>	<i>Field Name</i>	<i>County</i>	<i>Producing Formation</i>	<i>Age</i>
	Anderson	Eddy	Grayburg	Permian
E-10	Arrowhead	Lea	Grayburg	"
A-11	Artesia	Eddy	Grayburg	"
B-10	Barber	Eddy	Yates	"
*B-10	Benson	Eddy	Seven Rivers	"
C-13	Caprock	Lea	Queen ?	"
	Comanche	Chaves	San Andres	"
E-9	Cooper	Lea	Seven Rivers	"
C-11	Corbin	Lea	Queen	"
A-11	Dayton	Eddy	San Andres	"
C-11	East Lusk	Lea	Seven Rivers	"
*C-11	East Maljamar	Lea	Grayburg and San Andres	"
E-8	Eaves	Lea	Yates and Seven Rivers	"
E-10	Eunice	Lea	Grayburg	"
*B-10	Fenton	Lea	Cherry Canyon	"
B-10	Getty	Eddy	Yates	"
B-12	Grayburg-Jackson	Eddy	Grayburg and San Andres	"
C-10	Halfway	Lea	Yates	"
E-10	Hardy	Lea	Grayburg	"
B-12	High Lonesome	Eddy	Grayburg	"
E-11	Hobbs	Lea	San Andres	"
E-8	Jal	Lea	Seven Rivers	"
E-8	Langlie	Lea	Seven Rivers	"
B-11	Leo	Eddy	Grayburg	"
B-12	Leonard	Eddy	Grayburg and San Andres	"
B-11	Loco Hills	Eddy	Grayburg	"
D-10	Lynch	Lea	Yates and Seven Rivers	"
E-9	Lynn	Lea	Seven Rivers	"
C-12	Maljamar	Lea	Yates, Queen, Grayburg and San Andres	"
E-9	Mattix	Lea	Yates and Seven Rivers	"
A-11	McMillan	Eddy	Queen	"
D-11	Monument	Lea	Grayburg and San Andres	"
D-10	North Lynch	Lea	Yates and Seven Rivers	"
C-12	North Maljamar	Lea	Grayburg	"
E-10	Penrose	Lea	Grayburg	"
A-12	Red Lakes	Eddy	Yates, Seven Rivers, Queen, Grayburg and San Andres	"
E-11	Rhodes	Lea	Yates and Seven Rivers	"
C-12	Robinson	Eddy	Grayburg	"
B-12	Russell	Eddy	Yates	"
C-10	Salt Lake	Lea	Yates and Seven Rivers	"
*D-10	Sam Simon	Lea	Seven Rivers	"
C-11	Shugart	Eddy	Yates and Queen	"
E-10	Skaggs	Lea	Grayburg	"
E-9	Skelly	Lea	Grayburg	"
E-10	South Eunice	Lea	Seven Rivers	"
E-12	South Lovington	Lea	San Andres	"
C-11	South Maljamar	Lea	Yates	"
B-12	Square Lake	Eddy	Grayburg	"
*B-11	Turkey Track	Eddy	Grayburg	"
D-11	Vacuum	Lea	San Andres	"
D-10	West Eunice	Lea	Seven Rivers	"
C-11	West Lusk	Eddy	Seven Rivers	"

* 1943 discoveries.

DEVELOPMENT

Drilling in West Texas and southeast New Mexico was less in 1943 than at any other time in the past 6 years. The number of exploratory or wildcat wells in southeast New Mexico was two more than in 1942, but the number of discoveries was the same.

TABLE III
SUMMARY OF WEST TEXAS OPERATIONS, 1938-1943

	1938	1939	1940	1941	1942	1943
Total wells drilled	2,018	1,854	1,866	2,325	1,320	902
Number of development producers	1,716	1,640	1,747	2,190	1,107	742
Number of exploratory wells	192	114	119	135	134	111
Number exploratory producers	46	28	47	27	33	17
Per cent exploratory success	24.0	25.4	39.4	20.0	24.6	15.32
Pipe line runs (millions of barrels)	74.37	81.91	112.91	117.57	81.03	98.07
1943 total producers, 759; dry holes, 143						
Total new locations announced, 1,246						

TABLE IV
SUMMARY OF SOUTHEAST NEW MEXICO OPERATIONS, 1938-1943

	1938	1939	1940	1941	1942	1943
Total wells drilled	559	648	542	371	339	260
Number of development producers	481	563	468	332	246	183
Number of exploratory wells	66	62	22	39	35	37
Number of exploratory producers	25	28	3	4	6	6
Per cent exploratory success	37.9	45.1	13.5	10.3	17.1	16.22
Pipe line runs (millions of barrels)	35.29	36.97	35.48	39.34	31.93	38.47
1943 total producers, 189; dry holes, 71						
Total new locations announced, 293						

WEST TEXAS OPERATIONS

The average number of active operations per week during 1943 was 210, of which 37 were exploratory or wildcats and 133 were development wells.

The least active week was the second in February with a total of 124 operations, 7 of which were exploratory and 117 development wells. The most active week was the last in December with 332 operations, 82 of which were exploratory and 250 were development wells.

SOUTHEAST NEW MEXICO OPERATIONS

The average number of active operations per week during 1943 was 79, 21 of which were exploratory and 58 were development wells.

The least active week was the second in January with a total of 58 operations, 13 of which were exploratory wells and 45 were development wells. The most active week was the third in December with 107 operations, 21 of which were exploratory and 86 were development wells.

Fluctuations in activity as indicated by the variations in the number of completions each month are shown graphically in Figure 2.

For the first time in its history as an oil province, West Texas and southeast New Mexico will probably have an outlet comparable with its ability to produce. This accounts for the increased activity in December, 1943. Present plans indi-

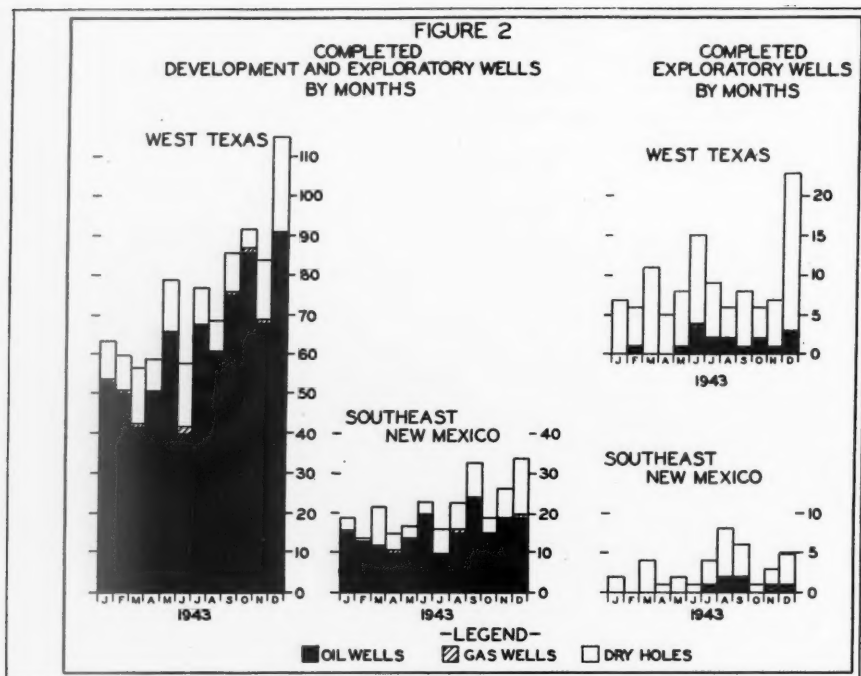


FIG. 2

cate that the district will be furnishing a substantially increased part of the war demands by April, 1944, when the reorganization of the pipe lines will be complete. Most important of the new lines is the Stanolind 16-inch line from the Slaughter field to Drumright, Oklahoma; it will not only connect West Texas with the Mid-continent by an overland route, but will help supply the requirements of the refineries in some of the partly depleted midcontinent oil districts.

Development of a large war demand for West Texas-New Mexico crude oil and transportation facilities to handle it is in contrast to the situation at the close of 1942 when the pipe-line runs were low and the distribution of allotments between the fields unequal on account of the disorganized transportation facilities caused by enemy sinkings of oil tankers.

DISCOVERIES IN WEST TEXAS, 1943

GENERAL

In considering new discoveries, it is observed that there is no generally accepted yardstick by the industry as to what constitutes a wildcat well. In the last

few years the tendency is toward linear measurement rather than a geological interpretation. By this definition, any drilling test located more than one mile from production is a wildcat or exploratory well. In this paper the exploration aspect is considered more from the geological angle.

Of 17 new discoveries in West Texas, only 9 are considered of sufficient importance for separate discussion. Of these, 4 are Ellenburger finds, 1 Silurian, 3 in the deep Permian, and 1 in the Grayburg of the upper Permian.

OUTSTANDING DISCOVERIES

With reference to Table V those discoveries of outstanding importance include the following.

F-10 Union.—The Union field, Andrews County, is 4 miles northwest of the Fullerton field, the outstanding discovery in 1942, and produces from the same zone of the deep Permian. It was found as a result of subsurface interpretation of the regional structural trend extending across the northwest part of the county. This discovery in the lower Permian, with initial flow of 460 barrels of 41.9° gravity oil from 7,450 feet, has stimulated exploration throughout this part of the county. The completion of sizable wells in the Fullerton pool with thick pay sections and the pronounced extensions of the field, both east and south, made it one of major proportions. One result was a detailed study of the entire trend, particularly by use of seismic methods. This was followed by spirited competition in the acquiring of high-priced leases.

F-12 Russell.—The Russell pool in northwest Gaines County, discovered by the Shell Petroleum Company, is another new area of the deep Permian. Although the pumping initial production of 213 barrels is not large, this extension of the lower Permian producing zones enhances the prospects for other pools in this part of the district.

The discovery well, Leaverton No. 1, Sec. 458, Block G, CCSDRGNG Survey, a failure in the San Andres dolomite, deepened to 7,792 feet, encountered a scattered pay section in dolomite, from 7,490 to 7,772 feet, of probable lower Clear Fork age. The crude oil tests 35.2° gravity, and there is little or no free gas. At the close of the year, a second producer, $\frac{1}{2}$ mile south of the discovery well, and of similar size, had been completed by the Magnolia and the Atlantic, and a third test was drilling. Rather slow development is expected.

I-9 Mabee.—Exploration of the deep Permian and pre-Permian throughout a major part of the year replaced the usual search for Grayburg and San Andres ("Big lime") pools of previous years. However, during the last quarter, The Texas Company discovered the Mabee pool in the southeast corner of Andrews County, east of the axis of the Midland basin, producing from lower Grayburg dolomite. A regional leasing campaign followed, extending in a broad belt north to the Cedar Lake pool, Gaines County, and south and southeast across Midland County, southwest Glasscock, northwest Reagan, and northeast Upton counties.

The discovery well, Mabee No. 1, Sec. 37, Block 40, GMMB&A Survey, with

TABLE V
NEW DISCOVERIES IN WEST TEXAS, 1943

Map Co./Ord.	County	Location	Pool	Operator	Farm	Date	Producing Formation	Pay Interval (Feet)	Initial Production	Discovery Method
F-10	Andrews	Sec 10 Blk A-31 PSL	Union	Union Oil Company	Biles 1	8-31	Lower-Clear Fork dolomite	7,259-7,441	F.460 oil	Subsurface
H-8	Andrews	Sec 28 Blk 9, Univ.	Clabber Hill	Skelly Oil Co.	Univ. 1-K	7-8	Holt-Clear Fork limestone	5,530-5,550	F.177 oil	Regional sub- surface and seismograph
I-9	Andrews	Sec 37 Blk 40 GMMB&A	Mabee	The Texas Company	Mabee 1	10-30	Grayburg- San Andres dolomite	4,640-4,730	S.170 oil br.	Seismograph
*G-6	Crane	Sec 2 Blk B-28 PSL	Sand Hills	Gulf Oil Corp.	Estes 1	6-17	Holt-Clear Fork limestone	3,830-3,883	P.17 oil & wtr.	Seismograph
K-3	Crockett	Sec 12 Blk Z, John Small	Shannon	Moore Bros.	Shannon 1	6-12	Grayburg limestone	2,278-2,402	P.45 oil & 11 wtr.	Subsurface and core drill
F-12	Gaines	Blk 458 CSDRNG	Russell	Shell Pet.	Leaverton 1	2-24	Lower Clear Fork dolomite	7,490-7,792	P.213 oil	Seismograph and subsurface
†I-15	Hockley	Sec 21 Blk A, R. M. Thompson	Smyer	Woodley Pet.	Harless 1	12-	Clear Fork dolomite	5,850-5,080	P.161 oil	Seismograph
M-10	Howard	Sec 57 Blk 20 LaVaca Nav. Co.	Vincent	W. S. Guthrie	Allen 1	6-12	Clear Fork limestone (Tubbs)	4,040-4,096	P.162 oil	Subsurface
G-4	Pecos	Sec 16 Blk 10 H&GN RR	Apco 1600	E. Russell Lloyd	Powell 1	11-7	Queen sand	1,649-1,661	F.88 oil	Subsurface
G-4	Pecos	Sec 90 Blk 10 H&GN	"Masterson 35"	Magnolia	State- Powell 1	7-8	Tubbs-Clear Fork dolomite	3,546	F.50 oil & 450 wtr.	Subsurface
†H-4	Pecos	Sec 101 Blk 11 H&GN	McCandless	McCandless	Atlantic	12-15	Ellenburger dolomite	4,012-4,037	F.250 oil	Acree deal and subsurface
H-3	Pecos	Sec 15 Blk 20 Univ.	Mule Creek	Brown & Harte	101 1 Univ.	10-6	Whitchose limestone	1,355-1,368	P.10 oil	Subsurface
I-4	Upton	Sec 65F G&SF	McCamey Shurian	T.P. C & O	1-15 I-15	12-4	Ellenburger dolomite	7,125-7,200	F.398 oil	Subsurface
F-7	Winkler	Sec 4 Blk B-3 PSL	Kernit	Magnolia	State- Walton 20	5-19	Ellenburger dolomite	10,635-10,774	F.388 oil	Subsurface
F-7	Winkler	Sec 1 Blk B-3 PSL	Keystone- Ellenburger	Carter & Gulf	Walton 2-C	6-14	Ellenburger dolomite	9,550-9,655	F.1,697 oil	Known structure
F-7	Winkler	Sec 15 Blk 46 Twp 1-S &P	Wheeler	Stanolind- Shell	Blue 1	7-9	Ellenburger dolomite	10,647-10,697	F.1,370 oil	Seismograph
F-7	Winkler	Sec 1 Blk B-2 PSL	Keystone- Holt	Richard- son-Bass	Walton 4	9-23	Holt-Clear Fork dolomite	4,705-4,800	F.251 oil	Subsurface

* Official potential not taken at close of year. Name submitted, but not official.

† Official potential not taken at close of year. Name is official.

‡ Official potential not taken at close of year. Name submitted, but not official.

potential of 161 barrels, had irregular "pay" through a dolomite section of about 90 feet, from 4,640 to 4,730 feet. It was drilled into water at 4,770 feet, and plugged back, but the operators were not successful in shutting off water. The oil is 31° gravity, and there is insufficient gas for flowing.

Two other wells, similar in size to the discovery, were in the process of completion by The Texas Company at the close of the year: one about 1 mile southwest of Mabee No. 1, and the other 1½ miles northeast, thus giving the pool a length of 3½ miles. Three other wells were drilling, each in separate sections of land. This is a seismograph discovery and it is apparent that the seismic control is being used to advantage in the location of the outpost tests.

Lack of pipe-line outlet has resulted in very little oil being produced since completion of the first well. There are few data concerning productive capacity of the three completed wells. It appears that the pool may be of considerable size.

I-4 McCamey Silurian.—Discovery of Silurian oil in the old McCamey field of Upton County by the Texas Pacific Coal and Oil Company's Lane No. 52-A, Sec. 5, GC&SF Survey, with initial flow of 398 barrels of 43.8° gravity crude oil is important; however, production later declined to 50 barrels oil per day. It is the second Silurian discovery in the district, and is on the east side of the Central Basin platform, 45 miles east of the first Silurian discovery in the Shipley (Silurian) field (G-5) of Ward County, on the west side of the platform. This is indicative of considerable regional productive potentiality for this zone and further exploration is predicted. The finding of oil in porous Silurian limestone in the McCamey field beneath shallow Permian production lends encouragement for deeper prospecting in other producing pools of known structure. Deeper drilling represents one of the best means in the district for finding new reserves of consequence.

The discovery well, originally an old shallow producer in the Grayburg-San Andres at 2,300 feet, was deepened to 8,358 feet and tested water in the Ellenburger. Operators then plugged back to 7,225 feet and gun-perforated casing from 7,125 to 7,224 feet; treated with 9,000 gallons acid, and completed for flowing initial production of 398 barrels of 43.8° gravity oil with gas-oil ratio of 1732. The oil, unlike that in the Shipley (Silurian) pool, does not congeal at normal temperatures.

Lithologic determinations of the rocks penetrated are tentative and include: dolomite and limestone predominant throughout the middle and lower Permian with base of Permian at 6,280 feet; detrital 6,280 to 6,360 feet; Devonian limestone and chert from 6,360 to 7,065 feet; Silurian (?) 7,065 to 7,200 feet; Montoya 7,200 to 7,335 feet; Simpson 7,335 to 8,190 feet; Ellenburger 8,190 to total depth, 8,358 feet. Water and a slight staining of oil occurred in fractured Ellenburger dolomite.

IMPORTANT DISCOVERIES, WINKLER COUNTY

Pre-Permian exploration, which featured the year's development, resulted in extending the area of Ellenburger production into Winkler County, and the dis-

covery of three pools. These finds started a leasing boom which fanned out from these discoveries and extended south and southeast into Ward and Crane counties. They also caused detailed seismic mapping of the pre-Permian, which resulted in the starting of several deep exploratory tests; a few were approaching critical depths at the close of the year.

F-7 Kermit-Ellenburger.—The Magnolia Petroleum Company's State Walton No. 20, discovery well of the "Kermit-Ellenburger pool," was the first Ellenburger completion in Winkler County. Amon Carter and the Gulf Oil Corporation's Walton No. 2-C, discovery well in the "Keystone-Ellenburger pool," had previously indicated large production in the Ellenburger, but was delayed in completion by mechanical difficulties.

The State-Walton No. 20, located in an area of shallow gas and oil production from the Whitehorse group, is a subsurface discovery. Location was made and drilling started, April 10, 1941. At that time, Yates subsurface control indicated the presence of a shallow syncline separating the Kermit and Keystone areas. Drilling progressed to 8,445 feet where operations were suspended on December 10, 1942, as a result of encountering Devonian chert, which was practically impenetrable at that time.

Drilling was resumed, January 6, 1943, after Ellenburger production was discovered at Monahans in Ward County. Deepening revealed the presence of a Simpson section; the top of the Ellenburger was reached at 10,460 feet and was penetrated 284 feet. The upper 183 feet contained gas and distillate. Five drill-stem tests showed varying amounts of gas increasing with depth to 7,000,000 cubic feet, and an estimated 10 barrels per hour of 54.4° gravity distillate. The last drill-stem test from 10,635 to 10,652 feet flowed 33 barrels oil in 15 minutes, then casing was cemented. The top of the oil "pay" was at 10,635 feet in highly fractured dolomite, and "pay" continued to the total depth of 10,774 feet. The well was completed, flowing initially 588 barrels of 43.3° gravity oil with gas-oil ratio of 1744; tubing pressure 1,790 pounds, and casing pressure 2,790 pounds per square inch. This is the deepest production in West Texas.

At the end of the year two Ellenburger tests were drilling in the area. The Magnolia's State-Walton No. 21, $\frac{3}{4}$ mile southeast of the discovery, was digging at 8,550 feet, and the second test, Magnolia's Walton No. 234, $\frac{3}{4}$ mile northwest of the discovery, had deepened to 8,550 feet. Both of these wells appeared to be checking with the discovery on upper pre-Permian markers.

Development costs per well are high due to an overall drilling time that approximates 8 months. This time will probably be reduced materially at a later date with bit improvements for penetrating the Devonian chert, and with the benefits of more knowledge gained as development of the pool progresses.

F-7 Keystone-Ellenburger.—Amon G. Carter and the Gulf Oil Corporation's No. 2-C Walton, discovery well of the Keystone-Ellenburger pool, Sec. 1, Block B-3, PSL, Winkler County, near the crest of the Permian structure, encountered the Ellenburger at 9,217 feet, being 1,200 feet higher than in the Magnolia's

State No. 20, 4 miles west. The top of the "pay" was at 9,550 feet in fractured Ellenburger dolomite, and continued to the total depth of 9,655 feet where the well was completed, flowing 1,697 barrels of 40.7° gravity oil through choke on casing, and a $\frac{3}{4}$ -inch choke on tubing. The gas-oil ratio was 1586. The interval from the top of the Ellenburger at 9,217 feet to the top of the "pay" at 9,655 feet contained large quantities of gas and distillate as shown by 6 drill-stem tests. One from 9,370 to 9,405 feet tested 19 barrels distillate per hour and 19,000,000 cubic feet of gas. Nine drill-stem tests were made; the last, from 9,630 to 9,655 feet, open 1 hour and 33 minutes, flowed 104 barrels oil during the last hour of testing. At the close of the year, 5 Ellenburger wells were drilling in the pool, 2 of which were below 8,200 feet. The field shows promise of prolific yields.

F-7 Keystone-Holt.—Richardson and Bass' J. B. Walton No. 4, SW. $\frac{1}{4}$ Sec. 5, Block B-2, PSL, Winkler County, an old producer in the Keystone pool at 3,376 feet, was deepened to 4,900 feet, plugged back to 4,800 feet, and completed, flowing initial 251 barrels of 39.4° gravity oil after acid treatment. The "pay" is in brown porous limestone and dolomite, and is tentatively correlated with the Holt pay zone. At the end of the year, several other tests of the area were deepening to this "pay": one, the Gulf's Keystone No. 46, $\frac{1}{2}$ mile southeast of the discovery, was showing several million cubic feet of gas. This discovery appears to be one of considerable importance in view of the size of the Keystone structure and the presence of this pay zone in Winkler County.

G-7 Wheeler-Ellenburger.—Oil was discovered by the Stanolind and the Shell near the center of the east line of Winkler County. Their Blue No. 1, Sec. 15, Block 46, T. 1 S., T&P Survey, made an initial flow of 1,370 barrels of oil of 46° gravity in fractured Ellenburger dolomite from 10,647 feet to 10,697 feet, total depth. This discovery is important in that: (1) it represents a major extension of the area of Ellenburger production on the Central Basin platform; and (2) it is a definite seismograph find, and indicates that the industry is making substantial progress in the mapping of deep pre-Permian structures on the regional platform.

At the close of the year there were 4 drilling wells in the Wheeler-Ellenburger pool, 2 of which were drilling below 9,000 feet, and a third well below 8,200 feet. Tentative interpretation indicates the presence of steep dips and probably small productive area but substantial yields.

ELLENBURGER DISCOVERY, PECOS COUNTY

H-4 McCandless pool.—Pecos County, which contains both the Abell and Apco-Warner pools, received considerable exploratory drilling in 1943, which resulted in one important Ellenburger discovery: Bryce McCandless' Atlantic 101 No. 1, Sec. 101, Block 11, H&GN Survey, had an initial flow of 250 barrels of 35.4° gravity oil in porous crystalline dolomite from 4,012 feet to 4,037 feet after deepening into water at the total depth of 4,103 feet and plugging back. The shallow depth, comparatively low drilling costs, and the presence of many short-term leases forecast considerable exploration during 1944. Several outpost wild-

TABLE VI
NEW DISCOVERIES IN NEW MEXICO, 1943

Map Co.Ord.	County	Location	Field	Operator	Form	Date	Producing Formation	Pay Interval (Feet)	Initial Production	Discovery Method
B-11	Eddy	3-19S-29E	Turkey Track	McKee	State 2	8-11	Grayburg dolomite	2,575-2,710	P. 20 oil and 16 wtr.	Acreage and subsurface
B-10	Eddy	15-21S-28E	Fenton	Schuster and Messenger	Page 1	9-11	Delaware Moun- tain sand	2,633-2,639	P. F. 20 oil	Subsurface and torsion bal- ance
B-10	Eddy	16-19S-30E	Benson	Harry Yates	Snowden and McSweeney	7-24	Whitehorse sand	1,828-1,836	P. 120 oil and 432 wtr.	Subsurface ?
C-11	Lea	22-18S-32E	South Mal- jamar	Maljamar	Cheasman 1	7-31	Grayburg limestone and sand	4,695-4,795	P. 75 oil	Subsurface
C-11	Lea	7-17S-33E	East Mal- jamar	McLaughlin and Cos- den	State 1	9-8	Grayburg and San Andres dolomite	4,195-4,234	P. 96 oil	Acreage and subsurface
D-10	Lea	5-22S-35E	San Simon	Skelly Oil Company	State 1-U	12-1	Seven Rivers	3,935-4,183	P. 122 oil	Regional sub- surface

cats were approaching critical depths at the close of the year, and several others were in the process of rigging up.

DISCOVERIES IN NEW MEXICO, 1943

Of 6 new discoveries in New Mexico, none was of outstanding importance. Near the close of the year, the Skelly Oil Company completed No. 1-U State in Sec. 5, T. 22 S., R. 35 E., the discovery well of the San Simon pool, Lea County. It pumped initial production of 122 barrels oil from broken pay sand of the upper Permian (Whitehorse) from 3,935 feet to 4,183 feet. This discovery is credited to regional subsurface geology. A second test, $1\frac{3}{4}$ miles southwest of the No. 1-U State, was drilling at shallow depth at close of the year.

B-10.—In the Russell area, Eddy County, Sudderth and Hicks completed Vickers No. 1 on November 20, in Sec. 23, T. 20 S., R. 28 E., for pumping initial production of 120 barrels natural of 20.0° gravity oil in the basal Yates (upper Permian) sand from 905 feet to 916 feet, total depth. Later classification may include this as the discovery well of a small pool.

NEW PRODUCING ZONES

There was no definitely new producing zone developed during the year, although at the close, two wells in the process of testing indicated considerable promise for two new "pays."

F-7.—In the Kermit-Ellenburger pool, Winkler County, the Magnolia's State-Walton No. 21, Sec. 4, Block B-3, PSL, encountered a heavy flow of gas in fractured Devonian chert in the interval from 8,273 feet to 8,281 feet. This is the first occurrence in the West Texas district of either gas or oil in the Devonian.

M-10.—In the Vincent pool, Howard County, W. S. Guthrie and Cosden Petroleum Company's Allen No. 2, Sec. 57, Block 20, LaVaca Navigation Company Survey, a failure in the 4,050-foot "pay" of the discovery well, was deepened and encountered oil of 31.6° gravity from 5,464 feet to 5,472 feet in porous fossiliferous limestone containing fusulinids indicative of basal Clear Fork or upper Wichita age. At the close of the year the operators were deepening and reported 2,400 feet of oil in the hole.

EXTENSIONS

Extensions of varying importance were made in 11 pools. Of these, the Slaughter field of Cochran and Hockley counties (H-14), was of major proportions. The productive area was extended from $\frac{1}{2}$ mile to 2 miles along its north border; the major spread was in Leagues 47 and 48, Edwards County School Lands, and north into League 45 of both Raines and Edwards County School Lands. Gradual expansion of the northwest and west limits occurred, and at the close of the year, it appeared that this pool would connect with both the Dean field, on the northwest, and the Rhodes area, on the southwest. Slight extensions were also in progress along its east flank.

TABLE VII
IMPORTANT EXPLORATORY WELLS COMPLETED, WEST TEXAS, 1943

Map Co. Ord.	Name of Well	County	Location Sec., Blk., Survey	Total Depth (Feet)	Oldest Formation Penetrated	Results	Date Completed 1943	Remarks
G-10	Fullerton, Wilson 6A	Andrews	16 A-32 P.S.L.	3,122	Yates sand	2,500 M.C.F. gas	6/19	Completed as gas well from 3,092 to 3,122 feet for drilling level. W. of Means field, showed thick Pennsylvanian section. Base of Permian 8,080 feet.
G-10	Humble, Crews & Mast 1	Andrews	8 A-34 P.S.L.	10,596	Pennsylvanian	D&A	12/18	
G-10	Mid-Cont., Univ. 1-B	Andrews	16 13 Univ.	7,458	Clear Fork	170 B/D after 9,000 gal. acid	11/11	24 miles SE. extension to Fullerton pool. Drilled into water and plugged back. Discovery method, subsurface geology.
G-9	Phillips, Univ. 45	Andrews	19 10 Univ.	8,015	Pre-Cambrian	f 245 B/D	9/11	A thin Ellenburger section with 15 feet of "pay." In 1975 to 7,990 feet, and top of granite 8,000 feet.
*H-8	Shelly, Univ. 1-K	Andrews	28 9 Univ.	7,500	Clear Fork	p 177 B/D after P.B. 5,550	7/8	Discovery well of Clabberhill pool. Failure in lower Clear Fork (?) Fullerton "pay." Plugged back to Holt "pay." Subsurface discovery.
H-9	Shelly, Univ. 1-M	Andrews	28 1 Univ.	8,487	Clear Fork	D&A	12/4	Dry deep wildcat with basin type of section, off east edge of Central Basin platform.
*I-9	Texas, Mabree 1	Andrews	37 40 T-2-N G&M B&A	4,770	San Andres (?)	p 300 B/D est. P.B. 4,704	12/31	Discovery well of Mabree pool. Producing from Grayburg dolomite. Drilled into water and plugged back. See discovery text.
*F-10	Union of Calif., Biles 1	Andrews	19 A-31 P.S.L.	7,450	Clear Fork	f 460 B/D	8/31	Discovery well of Union pool. 182-foot pay section. See discovery text.
*G-6	Gulf, Estes 1	Castro	10 9-T T&NO	5,700	Clear Fork	D&A	4/10	Furnished additional data on Clear Fork formation.
H-5	Gulf, Dawson 1-A	Crane	2 B-28 P.S.L.	7,777	Ellenburger	p 17 B/D after P.B. 3,883	6/18	Completed in Holt "pay" as discovery well of Sand Hills West pool. Top of San Andres 3,030 feet. Simpson 6,120 feet. Top Ellenburger 7,582 feet.
*K-3	Moore Bros., Shannon 1	Crockett	12 Z J. Small	2,567	Grayburg	p 45 B oil & 11 B water/D	6/12	Water and showing of oil in Simpson. Water in Ellenburger.
K-3	Moore Bros., Todd 1	Crockett	16 YZ EL&RR	7,993	Ellenburger	D&A	6/17	Discovery well of Shannon pool. Top of "pay" 2,278 feet. Discovery method, subsurface geology.
K-3	Turner & Phillips	Crockett	3 Archer C.S.L.	2,567	Grayburg	6,000 M.C.F. gas after P.B. to 2,100	9/20	Shows oil and/or gas in drillstem tests 6,793 to 6,796 and 6,796 to 6,870 feet. (See text.)
J-10	Darby, Harris 1-A	Dawson	16 268 Moore C.S.L.	5,512	San Andres	D&A	9/2	Admitted to oil in "wildcat" well. Top of "wildcat" topped at 6,700 feet. Top of Ellenburger 7,645 feet. Tested sulphur water in Grayburg at 2,478 to 2,546 feet.
G-11	Amerada, Robertson 6	Gaines	196 G WTRR	9,312	Pennsylvanian	f 453 B/D after P.B. 5,257	9/13	Extension gas well from Queen sand 1,895 to 1,958 feet through perforated casing. Water in Grayburg at total depth.
								Basin dry hole.
								First deep well on East flank of Seminole pool. Revealed thick section of Permian dolomite. Completed in regular Seminole San Andres "pay."

TABLE VII—Continued

Map Co.Ord.	Name of Well	County	Location Sec., Bk., Survey	Total Depth (Feet)	Oldest Formation Penetrated	Results	Date Completed 1943	Remarks
H-12	Gulf, Kotowitz 1	Gaines	02 G	6,070	Clear Fork	D&A	7/3	Regionally low well.
*F-12	Shell, Leaverton 1	Gaines	458 G	7,172	Clear Fork (?)	P 213 B/D	2/24	Discovery well of Russell pool. "Pay" 7,400 to 7,702 feet. Production is from same zone as Carter 4-D Wesson 6 miles NE. in Wesson pool. This well considerably lower subsea than Carter. See discovery text.
I-14	Livermore, Thomas 1	Hockley	29 A-27	5,321	San Andres	D&A	6/5	Low San Andres test.
*I-15	Woodley, Harless 1	Hockley	21 A	6,000	Clear Fork	P 166 B/D after P.B. 5,080	12/31	Discovery well of Smyer field in Clear Fork dolomite. Encountered 15 gals. salt water per hour from 5,097 to 6,000 feet. Possible opener of Permian pool of large atal extent.
*M-10	Guthrie, Allen 1	Howard	57 20	4,096	Clear Fork	P 162 B/D	6/12	Discovery well of Vincent pool. Top of "pay" 4,040 feet.
J-15	Sharp, Martin 1	Lubbock	18 D-6	6,242	Clear Fork	D&A	5/1	Water in Clear Fork on drillstem test.
K-15	Stanolind, Hester 1	Lubbock	12 4	4,838	Clear Fork	D&A	7/17	Structurally higher than near-by producing Stanolind Stinnet well, but no porosity or commercial oil.
I-9	Delaney, Scharbauer 1	Martin	27 39	5,201	San Andres	D&A	6/12	Additional data in Midland basin.
*G-4	E. Russell Lloyd, Powell 1	Pecos	76 10	1,661	Queen	f 88 B/D	11/7	Discovery of Apco 1600 pool in Yates sand. Subsurface geology was the method of discovery.
H-4	Stanolind, Jarrell 1	Parmer	19 B	8,162	pre-Cambrian	D&A	12/18	Geological data at 8,160. Additional data on thickness of sedimentaries.
	Anderson & Pritchard	Pecos	24 140	4,565	pre-Cambrian	Temp. abnd.	2/27	Settled from 30,000 M.C.F. of gas to 3,500 M.C.F. and was mudded because of rapid decline in volume.
*H-3	Brown & Choate	Pecos	15 20	1,368	Whitehorse	P 10 B/D	10/6	Discovery well of Mule Creek pool. Oil "pay" 1,355-08. Encountered 3,000 M.C.F. gas 830 to 1,020 feet in Yates sand section.
H-3	Gulf, Girvin 1	Pecos	60 11	4,537	pre-Cambrian	D&A	6/20	Only 93 feet of Whitehorse topped at 4,434 feet and showing sulphur water on drill-stem test.
F-3	Gulf, Rooney 1	Pecos	82 OW	5,423	Delaware Mountain	D&A	3/20	Top of Yates (?) 5,000 feet low well on east edge of Delaware basin.
G-4	Magnolia, Eaton 1-20	Pecos	29 3	8,315	Ellenburger	D&A	4/24	Top of Ellenburger 8,110 feet, very low datum.
*G-4	Magnolia, State 1	Pecos	96 10	3,557	Clear Fork	f 50 B oil and 450 B sulphur water/D	7/8	Top of Simpson 6,375 feet. Discovery well of Masterson 3,500 pool. Cased through and gun perforated with 3 shots, unlogged. Produced water and gas 3,539 to 3,546 feet. Subsurface geology method of discovery.
F-4	Magnolia, Robertson 1	Pecos	16 142	7,608	Delaware Mountain	D&A	1/16	Penetrated a Whitehorse reef limestone, before reaching total depth in Delaware Mountain sand.
G-4	McCandless, Turney 1	Pecos	19 141	4,986	pre-Cambrian	D&A	11/6	Top of pre-Cambrian 4,985. Permian on pre-Cambrian.
G-4	McCandless, Univ. 1	Pecos	20 26	5,514	pre-Cambrian	D&A	5/22	Permian into detrital zone with exceptional thickness of 800 feet. Top of detrital 4,715 feet, top of granite wash 4,850 feet, top of granite 5,512 feet.

TABLE VII—Continued

<i>Map Co. Ord.</i>	<i>Name of Well</i>	<i>County</i>	<i>Location Sec., Blk., Survey</i>	<i>Total Depth (Feet)</i>	<i>Oldest Formation Penetrated</i>	<i>Results</i>	<i>Date Completed 1943</i>	<i>Remarks</i>
*H-4	McCandless, Atlantic 1-101	Pecos	101 11 H&GN	4,103	Ellenburger	To be tested, Est. 300 B/D	12/31	Discovery well of unnamed pool, will probably be called McCandless. Ellenburger "pay" 4,012 to 4,037 feet. See discovery text.
G-4	Mid-Continent, Shearer 1	Pecos	107 10 H&GN	4,726	pre-Cambrian	D&A	10/5	No Ellenburger present. Well located on South edge of Apco pool. Top of detrital 4,530 feet, top of Permian 4,723 feet.
J-3	Standard of Texas, Douglass et al. 1	Pecos	9 104 GC&SF	9,114	Ellenburger	D&A	8/11	Top of Ellenburger 8,773 feet, top of Permian 8,773 feet. Placed back to 8,731 feet and acidized basal Simpson limestone with 17,000 gals. which had shown 50 feet of 41-4° gravity oil on drill-stem test from 8,650 to 8,731 feet. Deep test off the west edge of the Yates pool.
	Superior, Cordova Union 1	Pecos	3 Pink Phelps	4,862	pre-Cambrian	D&A	3/6	Only 35 feet of Ellenburger topped at 4,715 feet. Granite wash 4,750 to 4,800 feet, granite to 4,800 feet.
L-5	Humble, Sawyer 1-B	Reagan	13 1 T&P	9,995	Ellenburger	D&A	6/10	Top of Ellenburger 9,957 feet contained sulphur water.
D-5	Johnson, Perkins 1	Reeves	18 C-7 P.S.L.	5,267	Delaware Mountain.	D&A	6/5	Top of Delaware Mountain sand 5,039 feet regionally low containing water.
N-11	Humble, Newman 1	Scurry	258 97 H&TC	8,336	Ellenburger	D&A	1/23	Showed position of Ellenburger in area.
M-8	Colter, Read 1	Sterling	8 30 W&NW	9,387	Ellenburger	D&A	4/3	Top of Ellenburger 9,385 feet, very porous, lost circulation to total depth.
M-7	Phillips, Sterling 1	Sterling	3 31 T-5-S	9,303	Ellenburger	D&A	12/25	7,700 feet of sulphur water on drill-stem test from Ellenburger. Top of Ellenburger 9,265 feet.
N-6	Ohio, Clark 1	Sterling	6 GC&SF	8,486	Ellenburger	D&A	3/20	Top of Ellenburger 7,705 feet. Penetrated Ellenburger section.
*I-4	Roberts, Allison 2	Sutton	25 K GH&SA	3,761	Strawn	6,640 M.C.F. sweet gas	1/9	Discovery well of gas field.
	T.P.C.&O., Lane 52-A	Upton	5 GC&SF	8,358	Ellenburger	f 398 B/D oil after F.B. 7224	12/4	Discovery of Silurian production under McCamey (Grayburg) pool. An old well deepened. See discovery text.
*F-7	A. G. Carter & Gulf, Walton 2-C	Winkler	1 B-3 P.S.L.	9,655	Ellenburger	f 431.8 of f 678.8 B/D oil on 6-hr. test	6/14	Key discovery. See discovery text. Method of discovery, subsurface geology and wildcard drilling. See discovery text.
*F-7	Magnolia, State Walton 20	Winkler	4 B-3 P.S.L.	10,774	Ellenburger	Gr. 40.7° f 588 B/D oil Gr. 41.0°	5/19	Discovery well of Kermit Ellenburger pool. Discovered by subsurface geology. See discovery text.
*F-7	Richardson & Bass, Walton 4	Winkler	5 B-2 P.S.L.	4,900	Clear Fork	f 251 B/D oil after F.B. 4,860 Gr. 41.0°	9/23	Discovery well of Keystone Holt. "Pay" 4,075 to 4,800 feet. Water 4,800 to 4,900 feet successfully tested.
*G-7	Stanolind-Shell, Blue 1	Winkler	15 46 T-1-S T&P	10,697	Ellenburger	f 1,370 B/D oil Gr. 40.0°	7/9	Discovery well of Wheeler pool. See discovery text.
G-13	Barnsdall, Heath 1	Yoakum	315 D J.H.G.	7,600	Wichita	D&A	4/3	Additional data on thickness of Permian beds.
G-12	Stoddard, Kendrick 1	Yoakum	748 D J.H.G.	7,995	Clear Fork	D&A	12/11	Thickening basin type of section east of Wasson pool. Low well.
F-12	Humble, Tannehill 1	Yoakum	840 D J.H.G.	7,959	Clear Fork	D&A	5/29	Dry in Clear Fork "pay" of Russell pool at south and Wasson Deep at southeast.

Abbreviations used: B, barrels; D, day; f, flowed; Gr., gravity; n, pumped.

* 1943 discoveries.

TABLE VIII
IMPORTANT EXPLORATORY WELLS COMPLETED, SOUTHEASTERN NEW MEXICO, 1943

Map Co. Ord.	Name of Well	County	Location	Total Depth (Feet)	Oldest Formation Penetrated	Results	Date Completed 1943	Remarks
*B-11	McKee, State 2	Eddy	3-19S-29E	2,815 PB. 2,710	Grayburg	p 20B oil plus 16B wtr./D	8/11	Discovery well of Turkey Track area, top of "pay" 2,575 feet, Grayburg dolomite.
*B-10	Schuster & Messinger, Page 1	Eddy	15-21S-28E	2,649	Delaware	184, 376' shot 20B/D oil	9/11	Discovery well of Fenton area. Top of "pay" 2,638 feet. Producing from Cherry Canyon.
*B-10	Yates, Snowden & McSweeney, State 1	Eddy	16-19S-30E	1,836	Mountain (Cherry Canyon?) Whitehorse	p 120B oil plus 432B wtr./D natural Gr. 24.0° D & A	7/24	Discovery well of Benson area. A cable tool test.
E-8	Anderson & Pritchard, Marion 5	Lea	23-25S-37E	5,026	Yeso	p 75B oil/D Gr. 33.5°	8/3	Salt water and small showings of oil in Yeso.
*C-11	Marion 5 Chesman 1	Lea	22-18S-32E	4,840 PB. 4,795	Grayburg		7/31	Discovery well of South Maljamar. Top of "pay" 4,603. Grayburg dolomite and sand. Shot with 270 qts.
*C-11	McLaughlin & Cosden, State 1	Lea	7-17S-33E	4,234	Grayburg	p 66 B/D natural Gr. 37.5° Temp. Compl.	9/8	Discovery well of East Maljamar pool. Top of Grayburg "pay", 4,195 feet.
E-8	Olsen & Atlantic, Langlie 1	Lea	11-25S-37E	9,592 PB. 4,880	Pre-Cambrian	3,000 M.C.F. gas	10/3	Drilled pre-Cambrian from 9,555 to 9,592 feet. Cased to 9,592 and tested through gun perfora- tions from 4,700 to T.D. 9,592 feet. Temporarily completed 1 P.B. 3,000 M.C.F. gas well from the Pre-Cambrian. Shot with 270 qts.
*D-10	Skelly, State 1-U	Lea	5-22S-35E	4,183	Seven Rivers sand	p 122 B/D Gr. 37.4° after shot	12/1	Discovery well of San Simon area. Top of Basal Yates and Upper Seven Rivers sand "pay" 3,935 feet.

* 1943 discovery.

Abbreviations used: B, barrels; D, day; f, flowed; Gr., gravity; P, pumped.

The Wasson field of Yoakum and Gaines counties (F-G 12), the second largest productive area in West Texas, had minor extensions of small to medium-sized wells along its east, northeast, and northwest borders, and extension drilling of the deep Permian, producing in the south part of the field, was in progress.

The Fullerton pool of Andrews County (G-10), the outstanding discovery of 1942, had a major extension of $1\frac{1}{2}$ miles east by the Bay Petroleum Company's Bitler and Lowe No. 1, Sec. 12, Block A-32, Public School Lands, and a $2\frac{1}{2}$ mile spread southeast by the Mid-Continent's University No. 1, Sec. 16, Block 13, University Lands. These, with minor extensions north, expanded the field into one of sizable proportions with limits undefined.

In the Embar pool, Andrews County (G-8), the productive area of both the Ellenburger and Tubbs Permian was gradually expanded. The limits of the pool for the Ellenburger "pay" were practically defined by failures. The productive area includes about 1,280 acres. The Tubbs Permian producing area was gradually extended along a north-south belt including the east part of the Ellenburger producing area, and extending $\frac{1}{2}$ mile beyond its east limits. The productive area is 2 miles long and $\frac{3}{4}$ mile wide. Gradual expansion also occurred in the Mascho pool, northeast of the Embar pool (G-9), with small to medium-sized completions.

TABLE IX

(Summary of oldest formations tested in important completed exploratory wells in West Texas, Table V.)

Formation	Wells	Formation	Wells
Delaware Mountain (Permian)	3	Clear Fork (Permian)	15
Yates Sand (Permian)	2	Wichita (Permian)	1
Whitehorse (Permian)	1	Strawn (Pennsylvanian)	3
Grayburg (Permian)	2	Ellenburger (Ordovician)	15
San Andres (Permian)	4	Pre-Cambrian	8

TABLE X

(Summary of oldest formations tested in important completed exploratory wells in southeast New Mexico, Table VI.)

Formation	Wells	Formation	Wells
Cherry Canyon, Delaware Mountain (Permian)	1	Grayburg (Permian)	1
Whitehorse (Permian)	1	Yeso (Permian)	2
Seven Rivers (Permian)	2	Pre-Cambrian	1
Queen Sand (Permian)	1		

Minor extensions occurred along the east and northeast sides of the North Cowden pool (H-8), Ector County, and along the east and south flanks of the Seminole pool (G-11), Gaines County.

Queen sand production in the Weiner pool (F-7), Winkler County, was extended northwest and southeast, and in the Noelke and Olsen areas (K-3), Crockett County, there were minor extensions of both the gas- and oil-producing areas.

The Barnhart pool (L-4), of Ellenburger production in Reagan County, was extended 1 mile north by the Amerada's Johnson *et al.* No. 1, Sec. 5, HE&WT Survey, flowing initially 1,450 barrels of 43.2° gravity oil. Gradual expansion of

drilling to the west gave the field an east-west length of $3\frac{1}{2}$ miles, and north-south of 2 miles.

There was no major extension to any of the New Mexico pools. At Maljamar (C-11), the productive area was extended east; in the Lynn pool (E-9), there were minor north extensions along the west flank, and the Square Lake pool was extended east.

EXPLORATORY METHODS AND RESULTS

The table on geophysical operations shows a definite trend of expansion in West Texas, features the outstanding increase in number of gravimeters in use, and shows a more moderate increase in seismograph units. Employment of the gravimeter has been dominantly in regional surveys, particularly in the frontier areas, although some detail mapping was accomplished.

Seismograph surveying was widespread, and extended from the South Plains region into the Edwards Plateau province with an increase in the latter area. More than half the total units in the district were employed in detail mapping of the deep Permian and pre-Permian stratigraphy of the Central Basin platform and its environs. Major concentration was in Andrews County where 10 crews operated throughout a large part of the year.

Subsurface studies were intensified, particularly of the lower Permian and pre-Permian sediments furnished by drilling wells. These investigations were of a three-fold nature, including the search for structure, porosity, and stratigraphic traps. There was an attempt at further refinement of correlations and subdivision of critical formation by microscopic studies and insoluble-residue work with more attention directed to mud logging, drilling time, coring, and electric logging as definite aids toward the success of exploratory drilling.

Several surface parties were employed in the frontier areas throughout the west and northwest part of the district in the mapping of surface structure and study of stratigraphy.

STRATIGRAPHY

To the writers' knowledge there have been no changes in nomenclature in the area. There were three newly defined units. The Lovington sand member of the San Andres (Permian), approximately 100 feet below the top of the formation, was described by John M. Hills in "The Oil and Gas Resources of New Mexico," pages 270 and 271, and by W. T. Schneider in the Wasson field. The Cañas and Joyita members of the upper Yeso (Permian) were described and defined by C. E. Needham and Robert L. Bates.

The limits of the Abo, Yeso, Glorieta, and San Andres formations are redefined, the type sections designated, and the lithologic characteristics of each formation described in detail at its type section by C. E. Needham and Robert L. Bates. The descriptions of the formations are sufficiently detailed to enable subsurface geologists to correlate them with descriptions of well formation cuttings.

TABLE XI
IMPORTANT DRILLING WELLS, WEST TEXAS, CLOSE OF 1943

No. on Map	Map Co. Ord.	Name of Well	County	Location Sec., Blk., Survey	Depth (feet)	Remarks
1	E-10	Ray, Bitter & Lowe 1	Andrews	12 A-32 P.S.L.	7,381	1½-mile east extension to Fullerton pool, testing and showing for producer.
2	E-9	Humble, Scarborough 1	Andrews	7 A-40 P.S.L.	5,800	Northwest of Embury pool, on postulate, deep trend.
3	G-10	Mid-Continent, University 1-7	Andrews	20 43 Univ.	R.U.R.	Fullerton pool, center of intense seismicograph activity
4	G-9	Humble, Carter 1	Andrews	23 A-46 P.S.L.	10,050	First deep drilling in Deep Rock-Fuhrman area. Encountered mainly dolomite and limestone throughout all middle and lower Permian with scattered showings of oil. Drilled 1,000 feet of undifferentiated Pennsylvanian below base of Permian at about 8,850.
5	E-10	Shell, Cox 1	Andrews	5 A-31 P.S.L.	7,450	Fullerton Clear Fork pay project along trend 4 miles northwest of Union pool.
6	H-10	Hinton, Frazier 1	Andrews	25 A-35 P.S.L.	4,100	Exploratory well for Grayburg production along east flank of Shafter Lake area, 1½ miles southeast of Fullerton pool.
7	A-10	Hinton, Texas American Syndicate 1	Brewster	66 10 GH&SA	7,785	1½ miles southeast of Fullerton pool. Cretaceous surface structure, temporarily abandoned. May, 1943, in beds of Simpson age, will attempt to deepen to Ellenburger.
8	A-10	Seaboard & T. P., Evans 1	Cochran	15 Y P.S.L.	5,135	Outpost in west part of county, testing weak oil showings in Slaughter and Dean pay zones of which are of interest because of large salt crystal inclusions in oil-saturated dolomite section.
9	H-6	Gulf, Waddell 43-0	Crane	20 B-26 P.S.L.	3,200	Ellenburger exploratory well in north part of Tubbs area 5 miles north of Ellenburger production in Sand Hills pool.
10	G-5	Gulf, Estes 2	Crane	8 B-28 P.S.L.	Rigging	One mile southwest of the small discovery well of the Sand Hills West pool.
11	H-5	I. I. Moore, Barnaley Est. 1	Crane	42 32 P.S.L.	4,561	Outpost to Tubbs Sand Hills area 2½ miles east of Ellenburger production and 3 miles southeast of Tubbs Permian. Showing oil in Tubbs Permian, testing.
12	K-12	Humble, Reynolds 1-B	Culberson	33 62 P.S.L.	2,211	Deep frontier test located on regional Apache Mountain uplift.
13	K-12	Gulf, Dean 1	Dawson	30 30 P.S.L.	10,300	Ellenburger test in northeast part of county. Tight well. Reported drilling in lower Pennsylvanian, with several oil showings in lower Permian.
14	K-11	Seaboard, Sprayberry 1	Dawson	38 B-34 T-S-N T&P	7,079 P.S.	Southeast part of county. Testing oil showings in lower Permian. Showed 500 feet of oil and water.
15	H-7	Shell, Johnson 1	Ector	37 44 T-S T&P	6,854	Ordovician test on Centra Basin platform between Harper, Goldsmith and Johnson pools.
16	H-8	Standind, Cowden 1-B	Ector	12 44 T-S-N T&P	9,200	On Centra Basin platform 2 miles northwest of North Cowden pool. Temporarily abandoned, March, 1941, at 7,000 feet. Deepening has revealed a platform type of dolomite and limestone section through middle and lower Permian with showings of oil in Tubbs and Fullerton Clear Fork "pays."
17	M-17	Pure, Martin 1	Floyd	7 T BS&F	4,500	Wildcat along Motley Floyd pre-Cambrian trend in central part of county north of town of Pockahontas.
18	H-10	Texas, Farmer 1	Gaines	Lab. Log. P.C.S.L.	8,097	2½ miles northeast of Means pool. A failure in San Andres, Tubbs and Fullerton Clear Fork "pays." Well stopped in lower Permian.
19	G-12	Bay & King, Blair 2	Gaines	5 317 P.S.L.	7,193	Test of Wasson Deep, and Wasson 72 Clear Fork "pays" on southeast edge of Wasson field. Testing showings by swabbing tubing.
20	F-12	Continental, Jones 1-A	Gaines	22 A-7 P.S.L.	11,185	Deep test in west part of Russell pool. Middle and lower Permian are predominantly dolomite and limestone with top of undifferentiated Pennsylvanian Strawn (?) section at 9,000 feet.
21	H-11	Honclulu, Homaan 1	Gaines	96 G WTRR	5,457 P.S.	Showings of oil and water in San Andres. Temporarily completed as 4,100 M.C.F. gas well through casing perforations into lower Yates sand.
22	F-11	Humble, Cox 1	Gaines	14 A-11 P.S.L.	10,510	Deep test in west central part of county, middle and lower Permian dominantly dolomite and limestone to base at 9,600 feet which was also top of Pennsylvanian Strawn shales and limestone. Only showings recorded are in the San Andres from 4,000 feet to 5,300 feet.

TABLE XI—Continued

No. on Map	Map Co. Ord.	Name of Well	County	Location Sec., Bk., Survey	Depth (Feet)	Remarks
23	K-16	Amerinda, Kurfess 1	Hale	6 N HOB	10,183	Encountered pre-Cambrian beneath Mississippian at 10,150 feet. Upper and middle Permian to 6,720 feet were shale, dolomite, anhydrite, and salt, typical of this area. To 7,050 feet the section was mainly calcareous shale and limestone beds and probably involves both lower Permian and Pennsylvanian. Lower Pennsylvanian section of probable Strawn age consisting of limestone and shale in part arkosic from 7,050 to 9,400 feet, Bend (?) limestone and shale 9,400 to 9,600 feet. Top of Mississippian 9,600 feet.
24	H-16	Stanolind, Cobb 1	Hockley	Lab. Lge. 163 75	1,000	Exploratory well 15 miles north of Slaughter pool.
25	M-10	Guthrie & Allen, Allen 2	Howard	LaVaca Nav. 3	5,472	Showing oil in lower Permian, Wichita.
26	M-5	Humble, Sawyer 2-B	Irion	O.C. 12	8,550	Ellenburger test in west central part of county.
27	O-5	Shell, Tankersley 1	Irion	GC&SF 113	100	Ellenburger test.
28	J-14	Sobio, Allsup 1	Lynn	EL&R 12	6,603	To test lower Permian oil showing zones of Seaboard Sprayberry, Dawson County.
29	N-10	Col-Tex, Morrison 3	Mitchell	T&N 28	7,450	Ellenburger test in old Iatan field. First deep drilling in this discovery field of West Texas.
30	N-8	Shamrock, Elwood 1	Mitchell	SPRR 19	7,400	Ordovician test 11 miles east of Chalk Roberts pool.
31	H-4	Phillips, Pascoe 1	Pecos	H&GN 114	R.U.R.	Ordovician test 5 miles west of McCandless 1 Atlantic discovery.
32	H-3	Phillips, Univ. 1	Pecos	B-20 Univ. 36	2,600	Ordovician test 5 miles west of Taylor Link pool, on axis of Permian trend.
33	H-3	Standard of Texas, McDer 1	Pecos	T&S.L. 101	3,000	Ordovician test 64 miles southeast of McCandless discovery. Subsequently showing for a new discovery.
34	H-2	Phillips, Price 1	Pecos	TCRR 11	12,915	Frontier test 25 miles southeast of Ft. Stockton. Deepest drilling well and deepest well yet drilled in West Texas and New Mexico. Little data available on section below 11,000 feet. This depth indicates a thick shale body of probable Permian age. It is doubtful if Ellenburger test is present below 11,000 feet.
35	F-5	Standard of Texas, Trees 1	Pecos	H&GN 27	3,150	Ordovician test northeast part of county along west flank of regional Capitan reef trend.
36	C-5	Standard of Texas, Kessler 1	Reeves	P.S.L. 10	8,700	Deepest well in this part of Delaware basin. No data released. Subsequently abandoned at 8,894 feet in beds reported to be lower Bone Spring. Numerous small shows in Delaware Mountain-Leonard section.
37	G-6	Globe, Henderson 1	Schleicher	L 24	5,702	14-mile extension to Cooper Page gas field. Showing for typical size gas and oil.
38	G-6	Gulf, Edwards et al. 1-B	Ward	38 A	7,200	Oil shale well, located on platform 7 miles southeast of Monahans pool.
39	G-6	Shell, Sealey 3	Ward	P.S.L. 38	10,460	Oil shale well, Monahans pool discovery well the second deep test for the field.
40	F-8	Magnolia, State 21	Winkler	B-3 4	8,550	Reported checking several hundred feet lower than Shell's Sealy Smith No. 1 discovery.
41	F-8	Magnolia, Walton 234	Winkler	B-77 17	8,560	Ordovician extension Kermit Ellenburger pool, 1 mile southeast of the discovery well. Encountered large volume of gas in Devonian chert 8,273-8,281. First oil or gas in Devonian in this area.
42	F-7	Shinahr, Campbell 1	Winkler	B-5 11	9,500	Ordovician extension 1 mile northwest of Kermit-Ellenburger discovery well.
43	F-7	Stanolind, Sealy Smith 1	Winkler	A 59	4,000	Ellenburger wildcat 64 miles south of Carter's Walton 2-C discovery well of Texas.
44	G-13	Woodley, Farmer 1	Yoakum	GMMB&A 635	5,340	Tubing (Clear Fork) wildcat 7 miles northwest of Monahans pool.
45	F-13	Hickok & Reynolds, Price 1	Yoakum	J.H.G. 8	5,319	Two miles north outpost to Wasson pool. Testing. Will make small pumping well.
					4,400	San Andres wildcat test 15 miles northwest of Wasson.

Note.—At the close of the year there were five Ellenburger tests drilling in the Keystone Ellenburger pool, and four in the Wheeler Ellenburger pool. Present indications are that Wheeler pool will be a pool with steep dips and possibly small productive area.

TABLE XII
IMPORTANT DRILLING WELLS, SOUTHEASTERN NEW MEXICO, CLOSE OF 1943

No. on Map	Map Co'Ord.	Name of Well	County	Location Sec., Tsp., Rge.	Depth (Feet)	Remarks
1		Humble, State "N" 1	Chaves	35 14S 17E	3,046	Frontier wildcat on Manning dome southwest of Roswell.
2	A-10	Standard of Texas, Smith 1	Eddy	23 22S 24E	1,000	Exploratory well, west of Carlsbad along lagoonal side of reef trend.
3	A-10	Standard of Texas, Wilson 1	Eddy	3 22S 25E	920	Exploratory well, west of Carlsbad along lagoonal side of reef trend.
4	B-12	Yates & Yates, Evans 1	Eddy	5 17S 30E	6,587	Deep test in extreme west end of Square Lake pool.
5	E-11	Cone & Bery, State 1	Lea	30 18S 37E	3,410	Outpost 3 miles north of Monument pool.
6	E-12	Penrose, State 1	Lea	11 15S 35E	5,553	12 miles northwest of south Lovington pool. Tested salt water in upper San Andres on drill-stem test. To deepen.
7	F-8	Humble, Leonard 1	Lea	12 26S 37E	8,859	Ordovician wildcat in Rhodes area, reported in Pennsylvanian shale and limestone.
8	F-9	El Paso Nat. Gas, Ginsberg 1	Lea	7 25S 38E	8,300	Ordovician wildcat, Langlie area.
9	E-10	Continental, Skaggs B-23 No. 2	Lea	23 20S 37E	M.I.M.	11,000-foot test to Ordovician in Skaggs area.
10	C-13	Malco, State 1	Lea	31 12S 32E	3,030	Second producer Caprock area, from White-horse sand.

TREND IN EXPLORATION AND DEVELOPMENT

The industry's response to the need by our Government for large reserves of oil resulted in considerable deep exploration during the year with an increase during the last half. There was none of the usual seasonal let-up in drilling near the year's close.

The final approval by the Government and actual construction of additional pipe lines, both north to the Mid-Continent and east to tie in with main trunk lines, together with the looping, extension, and rearrangement of the present pipe-line systems, assures the district of a more certain and larger outlet for its oil, and places it in a more strategic position to play a vital role in winning the war.

TABLE XIII
GEOPHYSICAL OPERATIONS, 1943

WEST TEXAS			
Type	No. Jan. 1	June 1	Dec. 31
Seismograph	17	16	20
Gravimeter	4	8	11
Magnetometer	2	0	3
Core drill	1	2	1
Torsion balance	0	1	0
Electrical units	1	0	0
Total	25	27	35
NEW MEXICO			
Type	No. Jan. 1	June 1	Dec. 31
Seismograph	1	0	1
Gravimeter	2	2	2
Magnetometer	1	1	0
Core drill	0	0	1
Torsion balance	2	2	1
Electrical units	0	0	0
Total	6	5	5

The need for large reserves has accelerated exploration of the deeper zones of the lower Permian involving Tubbs and Fullerton and the evaluation of the pre-Permian. In several areas this included penetration of the entire sedimentary section into basement rock of pre-Cambrian age.

The whole trend in exploratory drilling has been toward a decided expansion, both with respect to depth and into new and outlying areas of frontier type in both West Texas and New Mexico. Deeper drilling in the known pools, which during the year resulted in discovery of two lower "pays" in the Keystone pool of Winkler County, one lower zone in the Kermit area, and the Silurian in the old McCamey pool, started a trend of exploration that will probably expand during 1944.

There was considerable development throughout the year along the flanks and edges of the older pools and of undrilled inside locations.

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Geological developments in 1943 included the publication of 15 papers on the stratigraphy, structure, paleontology, and development of the area. There were 2 geological papers on oil fields of West Texas, 2 on stratigraphy of New Mexico, 2 on surface geology of parts of West Texas, 1 on Permian paleontology, 6 on development, and 1 on the geology of New Mexico oil fields.

The paper by W. T. Schneider on the Wasson field, West Texas, is one of the most complete papers on an oil field to be published. The history, structure, stratigraphy, paleogeography, accumulation, and physical characteristics of the production of this 58,000-acre oil field are presented and analyzed. The paper includes cross sections, maps on the principal contacts, isopach maps, and, it is believed, presents in print for the first time the theory of primary porosity in the West Texas Permian reef dolomites. This conception of the primary or organic and depositional origin of dolomite porosity has had a large number of followers in West Texas since first presented in talks by E. Russell Lloyd 15 years ago. Many West Texas geologists assumed it to be a fact beyond question, even though it has not been so widely publicized as have theories that place an unconformity at the top of the "pay," or porosity, in West Texas dolomite oil fields and consider the porosity to be the result of erosion during the period of non-deposition. Schneider supports his conclusions with a wealth of data based on the microscopic examination of well-cutting samples from more than 500 wells in all parts of the 90-square mile Wasson field by himself and his co-worker, David M. Evans. The Lovington sandstone member of the San Andres, recently described by John M. Hills, is correlated into the Wasson field, and its significance fully discussed.

The other oil-field paper is a short preliminary note on the "Embar Field, Andrews County, Texas" by Taylor Cole. The field, though small at present, is important as the first Ordovician production north of Crane County, 50 miles to the south.

The papers on stratigraphy are: a geological note by Frank V. Stevenson on

the San Andres Mountains, describing some Devonian fauna and the first known occurrence of Devonian chert in New Mexico; and a paper by C. E. Needham and Robert L. Bates on the "Permian Type Sections in Central New Mexico" wherein the type sections of the outcrops of the Abo, Yeso, Glorieta, and San Andres formations are more adequately designated, delimited, and described in sufficient lithologic detail to be of assistance to the subsurface geologist working with these same formations as found in well cuttings and cores.

The papers on surface geology are by R. M. Huffington on the "Geology of Northern Quitman Mountains, Trans Pecos, Texas," and G. K. Eifler, Jr., "Geology of Santiago Peak Quadrangle."

Betty Kellett wrote a fine paper on "Permian Ostracods," presenting a potentially important field of investigation for future work by paleontologists working in the Permian.

The second edition of the "Oil and Gas Resources of New Mexico," by Robert L. Bates and others, is a complete revision of the first edition by Dean Winchester and contains many papers on the fields of New Mexico. This report is ably reviewed and supplemented by E. Russell Lloyd for the *Bulletin* of the American Association of Petroleum Geologists.

The 1942 Annual Report of the Oil and Gas Division of the Texas Railroad Commission, issued in December, 1943, furnishes statistical data on all West Texas fields, including notes on oil and gas legislation and the legal status of past and pending suits that interpret and establish the validity of this State Conservation Commission's rulings. In addition to the Association's development paper for 1942, by Robert I. Dickey and Bernard A. Ray, there was the development paper on West Texas, by Robert S. Dewey, for the Petroleum Division of the American Institute of Mining and Metallurgical Engineers, furnishing a complete coverage of the production of West Texas since discovery, and a discussion of the effect of the war on marketing conditions. A similar paper on New Mexico was written by John M. Kelly. Both papers maintain and add to the high quality of past technical publications by the American Institute of Mining and Metallurgical Engineers.

The National Oil Scouts and Landmen's Association published Volume XIII, "Yearbook for 1943, Review of 1942," giving a complete review of the drilling, leasing, and producing activity in West Texas and southeastern New Mexico.

The *Oil Weekly* reprinted, in separate form, an article from its September 6, 1943, issue on deep discoveries in West Texas. Most of the factual data presented on past and current deep discoveries of the Permian basin are tabulated in readily accessible form.

The geological department of the Midland County, Texas, library was recently increased by 750 volumes of geological publications presented by E. Russell Lloyd.

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DEVELOPMENTS IN NORTH AND WEST-CENTRAL TEXAS IN 1943¹

NORTH TEXAS GEOLOGICAL SOCIETY²

Wichita Falls, Texas

ABSTRACT

In 1943 the north and west-central Texas area contributed 52 discoveries and 40 extensions of proved fields or successful completions in new pay zones in areas already productive. This is comparable with 38 new discoveries and 12 extensions in 1942. Included with the 1943 discoveries are 6 gas wells.

In 1943, 1,483 wells were drilled in the area. Of these, approximately 400 were wildcats. This is comparable with 1,010 wells drilled, including 190 wildcats, in 1942, and indicates a 50 per cent increase in drilling activity for the year. The 1943 completions included 671 oil wells, 13 gas wells, and 799 dry holes.

Approximately 50,287,000 barrels of oil were produced in north and west-central Texas in 1943, as compared with 50,245,000 barrels in 1942. Wichita County again was the leading producer with 14,575,000 barrels during 1943, as compared with 15,591,000 barrels during 1942.

Probably the most important developments in the district in 1943 were: the discovery of a new deeper Strawn sand "pay" in the Walnut Bend "Winger" pool, Cooke County; the discovery of thick Bend (or Caddo) conglomerate "pay" above the Ordovician producing zone in the Hildreth pool of Montague County; the increased development and completion of dual wells in the Wimberly pool of Jones County; and the discovery of a new Caddo producing area designated as the Ellis field of northwest Jack County.

Several additional Mississippian limestone discoveries during 1943 added appreciably to the reserves of the area. Some of these discoveries were under old producing fields; a few were in wildcat territory, although the Wynn discovery is the only one which may indicate production to an extent comparable with the New York City Mississippian pool, in east-central Clay County.

The discovery of 33° gravity oil in a Cisco limestone in King County and 40° gravity oil in a basal Pennsylvanian conglomerate in northeast Wilbarger County on the north flank of the Electra arch enlarged the scope of possibilities in regions heretofore non-productive. The extent of the production in these areas remains speculative at this time.

Of the 92 discoveries and extensions found in 1943, there were: 1 each from shallow Permian limestone and Permian sand; 13 from shallow Cisco sands, 2 from Cisco limestones; 1 from Canyon limestone, 4 from Canyon sand; 24 from Strawn sands; 26 from Bend limestone, conglomerates, and sand (including 20 from the "Caddo" and 6 from the Marble Falls); 12 from the Mississippian limestone; and 6 from the Ellenburger. The Simpson series, although prospected by several wells, yielded no discoveries in 1943.

According to the available information the discovery methods responsible for the new producing areas and extensions are as follows: 4 random drilling, 5 surface geology, 43 subsurface geology, 24 seismograph, 1 geochemical, and 15 a combination of two or more methods. Seismograph and subsurface mapping continue to be the most effective methods of exploration in this district. At the end of the year, there were 12 seismograph crews, 3 gravity-meter crews, 1 magnetometer, and 3 core drills working in the area.

Despite the fact that production for the area as a whole showed no decline during 1943, new reserves discovered are apparently less than one third of the oil produced during the year.

INTRODUCTION

The north and west-central Texas districts include the area extending from the Llano uplift in central Texas, northward to the Red River and from the eastern rim of the Midland basin on the west side to include the Fort Worth syncline on the east side.

¹ Presented by title before the Association at Dallas, March 22-23, 1944. Manuscript received, March 27, 1944.

² Data for this article received from T. F. Petty, Humble Oil and Refining Company, Wichita Falls; D. D. Heninger, Ohio Oil Company, Wichita Falls; D. H. Cardwell, Sun Oil Company, Tyler; Carl Wheeler, Pure Oil Company, Wichita Falls; Roy Seitz, Independent geologist, Wichita Falls; compiled and edited by W. L. Haseltine, Magnolia Petroleum Company, P.O. Box 239, Wichita Falls.

The major structural features of the area are the Bend arch, extending due northward from the Llano uplift into Wichita County, flanked on the east by the Fort Worth syncline, which, commencing at approximately the center of the west line of Clay County, extends in depth southeastward through Clay County, across southern Montague County, through northeast Wise County, and across central Denton County. The Electra arch extends from northern Clay County westward across north Wichita County and central Wilbarger and Foard counties. The Muenster arch extends through the southeast corner of Cooke County diagonally across that county northwest and through northeast Montague County. The Red River syncline parallels the Electra arch on the north and increases in depth westward as it enters Wilbarger County and continues to deepen westward through north Hardeman County.

Development in north and west-central Texas in 1943 showed a marked increase over the previous year, with a total of 1,483 wells drilled, as compared with 1,010 wells drilled in 1942. There were approximately 400 wildcats drilled in 1943, as compared with 190 wildcats in 1942. The 1943 completions included 671 oil wells, 13 gas wells, and 799 dry holes. Approximately 50,287,000 barrels of oil were produced in north and west-central Texas in 1943. This is comparable with 50,245,000 barrels of oil produced in 1942. Approximately 29 per cent of the production in north and west-central Texas in 1943, or 14,575,000 barrels, came from Wichita County wells. However, Wichita County wells produced more than 31 per cent of the total production in the district in 1942, or 15,591,000 barrels.

Production for the area as a whole showed no decline in 1943, although certain fields declined somewhat, for instance, production from the KMA pool was approximately 460,000 barrels less in 1943 than in 1942. This decline was from the KMA Strawn sand which produced 1,190,000 barrels less in 1943 than in 1942; whereas the KMA Ellenburger production was increased by 733,000 barrels in 1943.

The new fields, extensions, and new producing formations in old fields discovered in the district in 1943 are indicated in Figure 1 and in Table I. They may be evaluated in importance as follows.

1. A new deeper Strawn producing sand was discovered in the Walnut Bend pool, Cooke County, Texas. This sand, with an average productive thickness of 50 feet, has been named the Walnut Bend "Winger" pool. At the close of the year there were 28 flowing wells. The Winger pool has been delimited by dry holes on the south and southwest.

2. The discovery of thick Bend (or Caddo conglomerate)³ pay zones above the Ordovician producing zone in the Hildreth pool, Montague County, indicated a producing area of several hundred acres. At the end of the year 9 wells were producing and 13 were drilling. The field has been delimited by dry holes on the southwest, east, and north.

³ The Caddo is a drillers term and includes several different formations of Lower Pennsylvanian age.

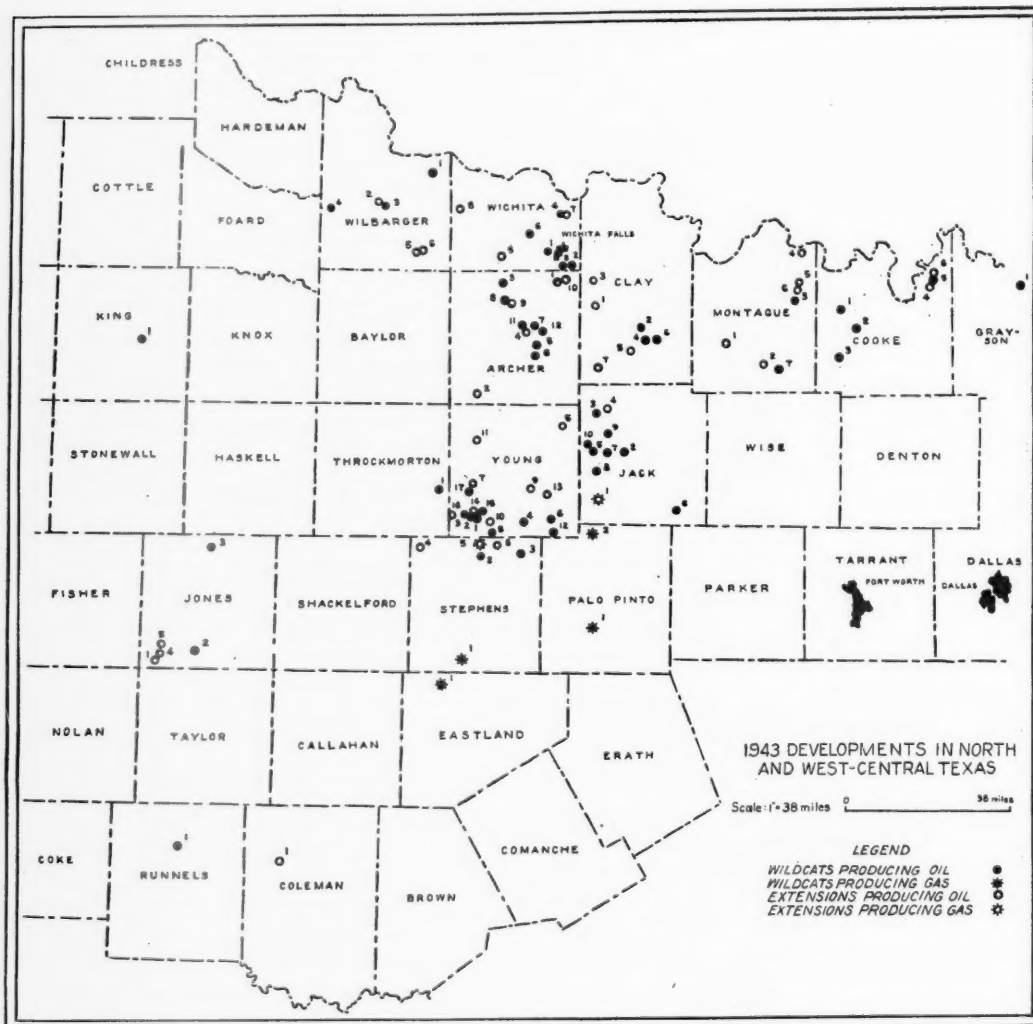


FIG. 1

3. Less spectacular, but of importance to the ultimate production in the district, was the orderly development and extension of the Wimberly pool, Jones County. During the year, 23 wells were drilled, most of which were completed from two depths, indicating the success of dual completions in this area.

The discovery of oil in new Cisco sands in the South Noodle pool, Jones County, added to the prospects in this area, but the extent of this development was speculative at the close of the year.

4. The discovery of a new Caddo producing area designated as the Ellis field, in northwest Jack County, indicated a fairly large area of possible Caddo production in the district. This field is too new to evaluate its size or extent, although 11 wells were completed at the close of the year.

5. Several new Mississippian limestone fields were discovered in north Texas in 1943, and have been classified as to importance tentatively as follows: Wynn, Knox Mississippian, Midway, Stephens, Hill Mississippian, Brownsville Mississippian, Pursley, and Barrett. Of these discoveries, probably Wynn is the only one which may indicate production to an extent comparable with the New York City Mississippian pool in east-central Clay County, located approximately 6 miles north and 1 mile west.

6. Of primary importance in extending production westward in the district was the discovery of 33° gravity oil in a Cisco limestone in King County, Texas. At the end of the year there was only one producing well, although others were being tested.

7. A basal Pennsylvanian conglomerate in northeast Wilbarger County indicated production on the north flank of the Electra arch in a region heretofore non-productive from shallower formations. The extent of this production is speculative.

8. There was some development in the KMA Strawn sand in Wichita County in 1943, which was given impetus by an extension well, completed in March, at the northeast edge of the older producing area. However, only a few wells were drilled as the area was proved to be too close to the water level to indicate flush production. Seven new Ellenburger wells were added to the expanding production from this formation in the KMA Ellenburger pool underlying the KMA Strawn sand.

Of the 92 discoveries and extensions found in north and west-central Texas in 1943, there were: 1 each in shallow Permian limestone and Permian sandstone; 13 in shallow Cisco sandstone, 2 in Cisco limestone; 1 in Canyon limestone, 4 in Canyon sandstone; 24 in Strawn sandstones, 26 in Bend limestone, conglomerate, and sandstones (including 20 in the "Caddo," and 6 in the Marble Falls); 12 in the Mississippian limestone; and 6 in the Ellenburger. There were no discoveries in the Simpson series during 1943.

A tabulation of the more important dry wildcats of the area has not been attempted in this report, although there were numerous dry tests which added appreciably to the subsurface geological information of the district.

TABLE I
NEW POOLS—EXTENSIONS AND NEW PRODUCING FORMATIONS OR ZONES DISCOVERED IN 1943

Index No.	County	Field	Operator	Farm and Well No.	Location	Class	Date	Producing Formation	Depth Top Prod. (Feet)	Depth Plugged Back (Feet)	Initial Production (Barrels)	Method of Exploration
1	Archer	Browning Burns-Ickert	Browning Burns	Browning 3 Ickert 14	89, G. E. Co., 149 17, I. Holman	N. Fm.	7-28	Strawn sd.	4,920	4,080	Fl. 60-2 hrs.	Sub.
2	Archer	Luke	Cooper	Parkey 1 Wilson 27	1, SPRR, 419 1, 119, ATNCL	New	11-30	Strawn sd.	4,453	5,165	Fl. 159-8 hrs.	Sub.
3	Archer	Henry	Deep Oil Dev. Co.	Henry 1	35, S. C&P S/D	Ext.	12-20	Cisco sd.	4,926	5,443	P. 05-day	Seis. & sub.
4	Archer	Scottland	Henderson	Carter 1	21, S. C&P S/D	New	10-24	Cisco sd.	897	906	P. 30-day	Sub.
5	Archer	Scottland	Johnson	Coleman 1	21, S. C&P S/D	New	10-24	Cisco sd.	897	885	P. 30-day	Sub.
6	Archer	Scottland	McCarty & Coleman	Taylor 1	15, 17, ATNCL	New	10-13	Ord. dol.	5,130	5,718	Fl. 05-3 hrs.	Seis. & sub.
7	Archer	Scottland	McCarty & Coleman	Taylor "A" 6	13, 17, ATNCL	N. Fm.	12-12	Cisco sd.	1,638	1,640	P. 45-day	Sub.
8	Archer	Luke	McClure	Fuller 1	12, 1, H&TC, 926	N. Fm.	8-18	Caddo ls.	5,359	5,397	Fl. 17-10 hrs.	Sub.
9	Archer	Luke	White & Duncan	Kinder 1	8, W&D, 392	New	6-2	Cisco sd.	4,881	5,023	Fl. 110-7 hrs.	Seis. & sub.
10	Archer	Halseid Burns-Midway	Burns	Thompson 1	29, San. Aug. Univ. 493	N. Fm.	12-1	Strawn sd.	1,240	1,250	Fl. 30-15 hrs.	Sub.
11	Archer	Ross	Continental	Ross 11	31, W. Walker, 703	New	8-4	Miss. ls.	5,972	6,935	Fl. 150-3 hrs.	Sub.
12	Archer	Wynn	Continental	Stephens 1	21, W. Walker, 703	N. Fm.	3-24	Strawn sd.	4,950	5,527	P. 118-day	Sub.
13	Archer	Wynn	Continental	Clark 3	21, W. Walker, 703	N. Fm.	6-9	Miss. ls.	6,010	6,049	Fl. 121 oil-9 wtr.-6 hrs.	Sub.
14	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	12-5	Strawn sd.	3,950	6,135	Fl. 221-day	Sub.
15	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	12-5	Strawn sd.	3,955	3,080	P. 24-3 hrs.	Seis. & sub.
16	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	6-3	Strawn sd.	3,138	3,161	P. 10 oil-7 wtr.-4 hrs.	Sub.
17	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	8-4	Strawn sd.	1,148	1,192	P. 15-day	Sub.
18	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	12-23	Strawn sd.	744	766	P. 15-day	Sub.
19	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	11-18	Ord. dol.	2,176	2,181	Fl. 85-2½ hrs.	Sub.
20	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	12-19	Strawn sd.	4,479	5,614	P. 35-day	Sub.
21	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	7-20	Strawn sd.	4,289	6,010	P. 118-day	Seis. & sub.
22	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	N. Fm.	1-20	Strawn sd.	5,491	5,557	Fl. 111-3 hrs.	Seis. & sub.
23	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	7-12	Caddo ls.	3,644	3,665	2 M.C.F.-day	Sub.
24	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	5-12	Ord. dol. ?	1,379	1,384	P. 69-day	Sub.
25	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	10-27	Strawn sd.	4,768	6,011	2½ M.C.F.-day	Sub.
26	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	1-6	Caddo ls.	4,782	4,828	Fl. 18-1 hr.	Seis.
27	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	5-12	Strawn sd.	2,710	5,951	P. 65-day	Seis.
28	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	6-13	Cisco sd.	4,205	3,345	P. 01-7 wtr.-day	Seis.
29	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	12-21	Miss. ls.	4,338	5,634	P. 25 oil-15 wtr.-day	Seis.
30	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	3-10	Caddo ls.	4,342	5,631	Fl. 60 oil-15 wtr.-day	Seis.
31	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	6-9	Strawn sd.	3,520	6,040	Fl. 34-6 hrs.	Seis.
32	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	4-19	Permian ls.	4,575	4,589	Fl. 228-day	Seis.
33	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	5-10	Cisco sd.	2,440	2,448	P. 274-day	Sub.
34	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	11-27	Canyon sd.	2,195	2,206	P. 88-day	Sub.
35	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	5-15	Cisco sd.	3,990	4,812	Fl. 154-day	Geochem.
36	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	12-31	Cisco sd.	2,730	2,738	P. 253-day	Sub.
37	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	10-13	Cisco ls.	2,086	2,096	Fl. 63-day	Sub.
38	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	3-31	Caddo cgl.	3,688	3,793	Fl. 301-day	Surf.
39	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	N. Fm.	2-8	Caddo cgl.	6,065	6,109	Fl. 563-1½ hrs.	Seis. & sub.
40	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	N. Fm.	3-31	Caddo ls.	6,235	6,073	Fl. 44 oil-4 wtr.-3 hrs.	Seis. & sub.
41	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	New	12-15	Strawn sd.	2,754	4,342	Fl. 73-day	Seis. & sub.
42	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	N. Fm.	6-5	Strawn sd.	2,437	3,020	P. 15-day	Sub.
43	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	N. Fm.	7-28	Strawn sd.	2,435	2,339	P. 55-day	Sub.
44	Archer	Wynn	Continental	Ragg 1	21, W. Walker, 703	N. Fm.	2-24	Caddo ls.	6,068	7,786	Swab 40 oil-35 wtr.-8 hrs.	Seis.

TABLE I—Continued

Index No.	County	Field	Operator	Farm and Well No.	Location	Class	Date	Producing Formation	Depth Total Prod. Depth (Feet)	Depth Plugged Back (Feet)	Initial Production (Barrels)	Method Exploration
1	Palo Pinto		Gordon	Conway 1A	59, 2, T&PRR	New	8-5	Strawn sd.	3,095	3,073	1 M.C.F.-day	Ran. dr.
2	Palo Pinto		Reynolds	Allen & Ritchie 1	M. E. Master, 1461	New	1-1	Strawn sd.	1,460	1,471	3 M.C.F.-day	Sub.
3	Runnels	Winters	Pawnee Royalty	White 1	330, 64, H&TC	New	2-21	Cisco sd.	2,464	2,466	P. 25 oil-70 wtr.-day	Surf.
4	Stephens		Cherry-Kidd	David 1	46, 7, T&PRR	New	12-27	Canyon sd.	1,841	1,859	6 M.C.F.-day	Surf.
5	Stephens	Corbett Ranch	Rancho	Black Bros. 1	1144, T&EL	New	7-17	Caddo ls.	3,252	3,276	Fl. 6 oil-10 wtr.-day	Sub.
6	Stephens	Brownsville	Blanco	Robert 1	1092, T&EL	New	6-21	Miss. ls.	3,950	4,242	Fl. 180-5 hrs.	Seis.
7	Stephens	Brownsville	T&P Coal & Oil	Robert 1	1415, T&EL	N. Fm.	10-5	Miss. ls.	4,180	4,172	Fl. 180-5 hrs.	Sub.
8	Stephens	Brownsville	T&P Coal & Oil	Brown 2C	J. C. Garrett	N. Fm.	12-0	Caddo ls.	4,226	4,236	7 M.C.F.-day	Sub.
9	Stephens	Hill 12-A	T&P Coal & Oil	Hill 12-A	1122, T&EL	N. Fm.	2-3	Caddo ls.	4,226	4,236	Fl. 50-3 hrs.	Sub.
10	Throckmorton	Batchelor	Anderson-Pritchard	Batchelor 1	1601, T&EL	New	9-22	Caddo ls.	3,925	4,311	P. 72 oil-48 wtr.-day	Seis.
11	Wichita	Davidson	Consolidated	Davidson 1	J. McDowell, 194	New	8-18	Ord. dol.	5,130	5,134	Fl. 103 oil-10 wtr.-day	Seis.
12	Wichita	Airport	Consolidated	Lauhof 1	3, Cherokee CSL	New	7-28	Strawn sd.	4,457	5,401	Fl. 94-3 hrs.	Seis. & sub.
13	Wichita	West	Continental	Dillon 1	W. R. Scott, 254	New	8-11	Strawn sd.	4,235	5,087	Fl. 10-3 hrs.	Seis.
14	Wichita	KMA	Grace & Grace	Roller 1	47, R. J. Sargent, 16	New	11-20	Strawn sd.	4,180	4,450	P. 80 oil-10 wtr.-day	Ran. dr.
15	Wichita		Johnson	Lowrance 1	27, Tarrant, CSL, 28	N. Fm.	6-9	Cisco sd.	4,68	6,04	P. 14-day	Sub.
16	Wichita	Electra	Paradise	Wagoner 2-E	1, G&SF, 606	N. Fm.	4-7	Cisco sd.	1,244	1,255	P. 30-day	Ran. dr.
17	Wilbarger	Wilkinson	British-American	Wilkinson 1	103, Wagoner Col.	N. Fm.	8-25	Cisco sd.	2,025	2,055	Fl. 20-3 hrs.	Sub.
18	Wilbarger	Casterbury	Phillips	King-Wagoner 3	63, 14, H&TC	N. Fm.	6-23	Penn. cgl.	5,849	6,133	Fl. 75-day	Seis.
19	Wilbarger	Rogers-McCary	Rogers	McCrory 1	63, 14, H&TC	N. Fm.	7-10	Cisco sd.	2,936	4,272	Fl. 90-3 hrs.	Sub.
20	Wilbarger	Main	Texas	Main 1-A	86, 8, H&TC	New	8-18	Cisco ls.	1,476	1,499	P. 145-day	Sub.
21	Wilbarger	Main	Wagoner	Wagoner 1	8, 47, H&TC	Ext.	11-18	Ord. dol.	2,786	4,725	Fl. 90-21 hrs.	Seis. & sub.
22	Wilbarger		Wagoner	Wagoner 1	"MM" 1	Ext.	8-18	Ord. dol.	4,435	4,509	Fl. 99-3 hrs.	Seis. & sub.
23	Young	Edmonds	Anderson-Pritchard	Donnell 1	T. P. Purnell, 460	Ext.	9-1	Ord. dol.	4,313	4,374	Fl. 120-3 hrs.	Seis. & sub.
24	Young	Walsh	Anderson-Pritchard	Latimer 1	M. Edmonds, 91	New	8-2	Marble Falls	4,184	4,768	Fl. 132-day	Seis.
25	Young	Walsh	Anderson-Pritchard	Myers & Walsh 1	17, Young CSL	New	6-2	Caddo ls.	3,635	3,647	Fl. 65 oil-60 wtr.-day	Seis.
26	Young		Anderson-Pritchard	Martin 1-B	G. W. Walsh, 1553	New	11-13	Marble Falls	4,246	4,858	Fl. 378-3 hrs.	Seis.
27	Young		Anzac	Carpenter 1	C. W. Townsend, 1642	New	1-29	Strawn sd.	2,383	2,400	P. 66 oil-100 wtr.-day	Sub.
28	Young		British-American	Morrison 1	E. W. Sargent, 253	N. Fm.	9-22	Miss. ls.	5,180	5,537	Fl. 182 oil-106 wtr.-day	Seis.
29	Young		Deep Rock Fleming	Graham 1	J. M. McLauren, 211	New	8-11	Miss. ls.	4,439	4,457	Fl. 134-12 hrs.	Surf.
30	Young		Guiberson	Donnell 1	1205, T&EL	New	10-23	Marble Falls	4,250	4,927	Fl. 75-day	Sub.
31	Young		Hanlon-Buchanan	King 1-F	461, T&EL	N. Fm.	9-29	Marble Falls	3,914	3,920	Fl. 87-8 hrs.	Sub.
32	Young		Keith & Reimer	Wallace 1	M. W. Criswell, 1772	N. Fm.	12-2	Caddo ls.	3,835	4,737	Fl. 10-day	Seis.
33	Young	Padgett	Lipscomb	Scott 2	335, T&EL	Ext.	10-29	Marble Falls	4,104	4,108	Fl. 450-13 hrs.	Sub.
34	Young		McLester	Johnson 1	3, F. M. Drew, 1417	New	9-22	Miss. ls.	4,683	4,750	Fl. 84-3 hrs.	Seis. & sub.
35	Young	Knox (Miss. ls.)	Mudge	Harrison 1	F. Jaime, 157	N. Fm.	9-22	Marble Falls	3,990	4,003	Fl. 235-5 hrs.	Sub.
36	Young	Allar	Panhandle	Allar "D" 1	3490, T&EL	N. Fm.	2-2	Miss. ls.	4,604	4,707	Fl. 207-6 hrs.	Sub.
37	Young	Allar-Caddo	Panhandle	Mayer 1	S. Anderson, 3	N. Fm.	7-14	Canyon ls.	1,687	1,697	P. 150-day	Sub.
38	Young	Murray	Std. of Texas	Donnell 4	2371, T&EL	N. Fm.	4-21	Caddo ls.	3,552	3,573	Fl. 131-6 hrs.	Sub.
39	Young	Holbert-Caddo	Std. of Texas	Holbert 1	726, T&EL	N. Fm.	7-20	Caddo ls.	3,746	4,606	Fl. 317-day	Seis.
40	Young					New	1-20	Caddo ls.	3,857	5,276	Fl. 57-3 hrs.	Seis. & sub.

Under "Production", arranged in order as follows: Lot number, Section number, Block number, Survey name, Abstract number.

Under "Date", arranged in order as follows: Year, month, day. Production figures for 24-hour day unless otherwise indicated.

Under "Initial Production", arranged in order as follows: Year, month, day. Production figures for 24-hour day unless otherwise indicated.

Under "Method of Exploration", arranged in order as follows: Geom., geochemical survey; Ran. dr., no geologic or geophysical information; Seis., seismograph; Sub., subsurface; Surf., surface geology.

The discovery methods responsible for the new producing areas and extensions are as follows: 43 subsurface geology, 24 seismograph, 5 surface geology, 4 random drilling, 1 geochemical, and 15 a combination of two or more methods. Seismograph and subsurface mapping continue to be the most effective methods of exploration in the district. At the end of the year there were 12 seismograph crews, 3 gravity-meter crews, 1 magnetometer, and 3 core drills working in the area.

The trend in exploration and development in the district in 1943 was in the older producing areas (or county units) as evidenced by the 17 discoveries and extensions in Young County, 12 in Archer County, 10 in Jack County, 8 in Wichita County, 7 each in Clay and Montague counties, 6 each in Cooke, Stephens, and Wilbarger counties, 5 in Jones County, 1 each in Coleman, Eastland, Grayson, King, Runnels, and Throckmorton counties.

New reserves discovered in north Texas during 1943 can not be accurately estimated at this time, but are apparently less than one third of the oil produced during the year.

DEVELOPMENTS IN EAST TEXAS IN 1943¹

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ABSTRACT

Four new oil-producing areas and two new gas-producing areas were discovered in East Texas in 1943. Of the new oil areas, two produced from the Paluxy formation, one from the Pettit zone, and one from both the Rodessa and Pettit zones of the lower Glen Rose formation. One of the new gas areas produced from the Woodbine, the other from the Pettit zone of the lower Glen Rose. Exploratory drilling in East Texas was characterized in general by deeper drilling than in the past, most of the important tests having the Paluxy, lower Glen Rose, Travis Peak, and Smackover formations as their objectives.

INTRODUCTION

There was a slight decrease in drilling activity in the East Texas area (Fig. 1) in 1943. This decrease was occasioned by a decline of approximately $37\frac{1}{2}$ per cent in the number of wells drilled in producing areas. There was, on the other hand, a slight increase in the number of exploratory tests. The following table provides a detailed comparison of the year's activities with those of the previous year.

	1942	1943
Oil wells.....	235	135
Gas and condensate wells.....	25	24
Dry holes (fields).....	52	36
Dry holes (wildcats).....	99	104
Total.....	411	299

NEW FIELDS

Appleby (Nacogdoches County).—The Appleby gas and condensate area is 7 miles northeast of Nacogdoches in east-central Nacogdoches County. The discovery well, The Texas Company's G. W. Strahan No. 1, was drilled to the total depth of 9,295 feet, in the Travis Peak formation and was completed, April 27, 1943, through casing perforations from 8,610 to 8,660 feet. Initial production was 425,000 cubic feet of gas and 28 barrels of straw-colored, 51.7° gravity condensate per day.

The exact age and stratigraphic relationships of the producing section are admittedly debatable. For the purposes of this paper, it is assigned to the Pettit zone of the lower Glen Rose, although it has been referred by others to the Travis Peak. In the south part of the East Texas basin there is an apparent downward encroachment of the Glen Rose facies across "time-lines" and into stratigraphic levels which are recognized as Travis Peak farther north. The producing section consists of interbedded limestones, fine-grained sandstones, and sandy shales and

¹ Presented by title before the Association at Dallas, March 22-23, 1944. Manuscript received, April 7, 1944. Published by permission of the Magnolia Petroleum Company and the Humble Oil and Refining Company.

² Magnolia Petroleum Company.

³ Humble Oil and Refining Company.

OIL & GAS FIELDS OF EAST TEXAS 1943

NEW FIELDS (1943) OLD FIELDS
 (Location of important exploratory test)

GENERALIZED GEOLOGIC SECTION
EAST TEXAS

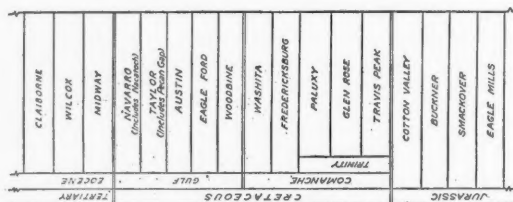


FIG. 1

therefore may be regarded as "transitional" between lower Glen Rose and Travis Peak. The second test for the area, The Texas Company's A. W. Pruitt No. 1, was drilling at the end of the year. No subsurface data are available to afford an estimate of the possible size of the producing area. Previous to the completion, both the Rodessa zone of the lower Glen Rose above, and Travis Peak sands below, the producing section had been tested, and yielded salt water. Although the completion of The Texas Company's Strahan No. 1 resulted in this area being named and designated as a gas and condensate field by The Texas Railroad Commission, the discovery well was later plugged and abandoned on September 1, 1943.

Campbell (Hunt County).—The Campbell field is near Campbell in eastern Hunt County. Production was established May 26, 1943, when the Stanolind Oil and Gas Company's H. C. Tilson Heirs No. 1 was completed, pumping 177 barrels of 30° gravity black, mixed but predominantly asphaltic-base oil and 42 barrels of slightly brackish water per day from the Paluxy formation through casing perforations from 4,358 to 4,363 feet. The well is on the Campbell fault structure, which was recognized from surface work by various geologists as early as 1924. Several Woodbine tests and one 6,570-foot Travis Peak test, the Stanolind Oil and Gas Company's Jessie P. Hawks No. 1, had been drilled on the structure previous to the discovery well. None of these earlier wells had recorded any significant showings of gas or oil. One additional producing well and two dry holes had been drilled by the end of the year. No other operations were in progress. The subsurface geological information indicates that the ultimate potential producing area will be small.

The oil was being transported by truck to the Tydal Refining Company at Gainesville, Texas. The cumulative production was approximately 25,000 barrels.

Following the completion of the discovery well at Campbell, the Stanolind drilled two Paluxy tests and one 5,992-foot lower Glen Rose test, located $4\frac{1}{2}$ – $6\frac{1}{2}$ miles northeast, near the town of Commerce, and along a northeast extension of the Campbell fault. All three of these tests were abandoned as dry holes.

Henderson (Rusk County).—The Henderson field is $3\frac{1}{2}$ miles northwest of Henderson, in west-central Rusk County, and is $3\frac{1}{2}$ miles east of the east edge of the East Texas field. The discovery well, the American Liberty Oil Company and Beacon Oil and Refining Company's J. H. Allen Estate No. 1, was completed, September 21, 1943, flowing 231.84 barrels of 43° gravity, dark brownish green, paraffine-base oil per day on a $\frac{1}{4}$ -inch tubing choke, with a gas-oil ratio of 623 to 1. Production was through perforations in casing from 7,250 to 7,264 feet, opposite an oölitic limestone of the Pettit zone of the lower Glen Rose formation. The structure is reported to have been a seismic prospect.

On January 1, 1944, the Beacon Oil and Refining Company's R. T. Brown *et al.* No. 1, 1,800 feet east and slightly south of the discovery well, was testing gas and condensate from the Pettit.

The oil from the discovery well was being delivered to the Sinclair Pipe Line

Company in the East Texas field. The cumulative production was between 12,000 and 13,000 barrels.

Manziel (Wood County).—The Manziel field is near Cartwright in north-central Wood County, approximately 6 miles north-northeast of Quitman. It is about 5 miles northeast of the Quitman field and 4 miles south-southwest of the Coke field. The discovery well was the Bobby Manziel *et al.* W. F. Bailey No. 1, drilled on a 40-acre tract farmed out by the Shell Petroleum Corporation and completed, April 23, 1943, flowing 247.5 barrels of 34° gravity, dark brown mixed-base oil on $\frac{1}{4}$ -inch tubing choke, with a gas-oil ratio of 176 to 1, from the Paluxy formation through casing perforations from 6,244 to 6,250 feet, 6,258 to 6,276 feet, 6,288 to 6,292 feet, and 6,313 to 6,319 feet.

Ten producing wells, 3 flowing and 7 pumping, and 3 dry holes had been completed, and 3 wells, including a Travis Peak test by the Shell Petroleum Corporation, were drilling at the end of the year. Showings of oil encountered in the deep test, the Shell's J. C. Whatley No. 1, in both the Rodessa and Pettit zones of the lower Glen Rose, indicated that additional reserves might be present.

During 1930 the Shell Petroleum Corporation mapped a surface nose in this area. McElreath and Suggett's B. D. Holley No. 1, dry Woodbine test drilled in 1934 and located just outside the present established limits of production at the northeast end of the field, further suggested the presence of structural abnormality. Seismic investigations between 1934 and the drilling of the discovery well served to localize the structure.

The structure is an anticline, complicated by faulting, with the major axis trending northeast and southwest, paralleling and directly in line with the axis of the Quitman structure on the southwest.

Production from this field is purchased by the Sohio Pipe Line Company and transported by truck to Coke for delivery to the Talco Pipe Line Company. The cumulative production was approximately 82,000 barrels.

New Hope (Franklin County).—The New Hope field is in southeast Franklin County, about 9 miles south and slightly east of Mt. Vernon. The Tide Water-Seaboard's A. J. Bacon No. 1, the discovery well, was completed, June 28, 1943, as a dual completion, flowing 165 barrels of dark, greenish brown, paraffine-base, 41.5° gravity oil with a gas-oil ratio of 231 to 1, on a 6/64-inch casing choke through perforations in casing from 7,295 to 7,305 feet, opposite a porous, oölitic limestone section at the top of the Rodessa zone, immediately below the base of the "massive anhydrite," and flowing 181 barrels of dark greenish brown, paraffine-base, 47° gravity oil, with a gas-oil ratio of 550 to 1, on a 9/64-inch tubing choke, through open hole from 7,900 to 8,090 feet, from a sand section which is regarded as correlative with the Pettit limestone zone of the lower Glen Rose.

Three oil wells had been completed, all as dual completions from the same zones described here, and four wells were drilling at the end of the year. The possible presence of an additional producing zone, a sand in the Rodessa zone, was indicated by core analyses.

The field is on an elongate, anticlinal structure, with the major axis trending northeast and southwest, and was a seismic prospect. The presence of pronounced structural relief was proved by the drilling of the Humble Oil and Refining Company's Solon King No. 1, a dry Travis Peak test, subsequent to the completion of, and about $2\frac{1}{4}$ miles northwest of, the discovery well. This test was about 25 feet lower than the discovery well on the top of the Pecan Gap chalk, showed progressive thickening through all formations below the Pecan Gap, and was 196 feet lower on the base of the "massive anhydrite."

The New Hope crude is purchased by the Gulf Pipe Line Company, which has an 8-inch line crossing the field. The cumulative production at the end of the year was approximately 121,000 barrels.

Steward's Mill (Freestone County).—The Steward's Mill field is near the community of the same name, 7 miles north and slightly west of Fairfield, in north Freestone County. Gas was produced in this area by the Carter-Gragg Oil Company's W. W. Steward No. 1, March 1, 1943. The initial production was 25,000,000 cubic feet of gas and 50 barrels of condensate per day on open-flow back-pressure test, through casing perforations from 4,001 to 4,006 feet, opposite the upper part of a sand in the upper Woodbine. A previous test through perforations from 4,019 to 4,022 feet in the lower part of the same sand, yielded salt water with a slight showing of oil and gas. Four other wells drilled in this immediate area during the past 3 years had recorded showings of gas and oil from the Woodbine. One of these wells, the J. L. Collins and Company's W. W. Steward No. 1, tested an estimated 10,000,000–15,000,000 cubic feet of gas per day with no salt water or oil, but was abandoned because of the thin productive section and the lack of a market for the gas.

One dry hole has been drilled by the Carter-Gragg Oil Company since the completion of the discovery well. The subsurface data afforded by the one producer and the five dry holes suggest a small producing area of low structural relief.

FIELD DEVELOPMENTS

Carthage (Panola County).—Important westward extensions of the Carthage field by as much as 5 miles, probably at least doubling the previously known productive area, occurred during 1943. Five new gas and condensate wells were completed during the year, one producing from the lower Pettit, two from the upper Pettit, and two as dual completions from both the upper and lower Pettit zones of the lower Glen Rose. In addition, two producing wells were deepened and re-completed. One of these originally produced from the upper Pettit and was drilled deeper and re-completed in the lower Pettit, while the other, originally completed in the Rodessa zone of the lower Glen Rose, was deepened and re-completed as a dual well, producing from both the Rodessa and upper Pettit zones.

On December 31, 1943, there were 18 gas and condensate producing wells in

the field. The various formations from which these wells were producing are indicated in the following table.

SINGLE COMPLETIONS	
Lower Pettit.....	5
Upper Pettit.....	3
Rodessa.....	3
DUAL COMPLETIONS	
Upper and lower Pettit.....	3
Lower Pettit and Rodessa.....	2
Upper Pettit and Rodessa.....	2

The cumulative condensate production was approximately 427,000 barrels.

Cayuga (Anderson, Henderson and Freestone counties).—Routine development in the Cayuga field in 1943 resulted in the completion of two oil wells and one gas and condensate well in the Woodbine, one gas and condensate well in the Rodessa zone of the lower Glen Rose, and two Woodbine dry holes. Fourteen Woodbine oil wells and two Woodbine gas and condensate wells were abandoned. At the end of the year there were 271 oil wells and 48 gas wells producing from the Woodbine and 7 gas and condensate wells producing from the Rodessa. Of the oil wells, 87 were flowing, 159 were pumping, and 25 were dead. Seven recycling and repressuring plants were in operation in the Cayuga field. Cumulative oil production was approximately 29,847,000 barrels, cumulative condensate production 2,970,000 barrels.

Chapel Hill (Smith County).—There was a marked decrease in drilling activity in the Chapel Hill field in 1943. Only 10 wells were drilled, as compared with 30 for the previous year. Of the 10 drilled, 6 were completed as oil wells producing from the Pettit, 2 as gas-condensate producers from the Rodessa, 1 as a gas-condensate producer from the Paluxy, and 1 as a dry hole. In addition, one Pettit oil well was plugged back and re-completed as a small oil producer from the Rodessa zone. The Paluxy was plugged off in one well originally completed as a dual well producing gas and condensate from the Paluxy and oil from the Pettit, and one Rodessa gas-condensate well and one Pettit oil well were abandoned in 1943.

The producing formations and nature of the production from the 60 wells which were producing at the end of the year are indicated in the following table.

SINGLE COMPLETIONS	
Pettit, oil.....	41
Pettit, gas and condensate.....	4
Rodessa, oil.....	3
Rodessa, gas and condensate.....	4
Paluxy, gas and condensate.....	3
DUAL COMPLETIONS	
Pettit oil, Paluxy gas and condensate.....	4
Pettit and Rodessa, gas and condensate.....	1

In summary, including the dual completions, 45 wells were producing oil and 5 were producing gas and condensate from the Pettit, 3 wells were producing oil

and 5 were producing gas and condensate from the Rodessa, and 7 wells were producing gas and condensate from the Paluxy.

Cumulative production from the Pettit was 1,355,000 barrels of oil and 243,000 barrels of condensate; from the Rodessa, 45,000 barrels of oil and 888,000 barrels of condensate, and from the Paluxy, 630,000 barrels of condensate.

Coke (Wood County).—Drilling in the Coke field was nearly completed in 1942, with the result that only 4 Paluxy oil wells and one dry Travis Peak test, located outside the limits of Paluxy production on the east flank of the structure, were completed in 1943. At the end of the year, there were 30 wells producing oil from the Paluxy. Twenty-seven of these wells were flowing and 3 were pumping. Cumulative production was about 525,000 barrels.

East Texas field.—No wells were drilled, and 385 wells were abandoned in the East Texas field in 1943.

The following table provides data for comparison of the number of producing wells in the various categories listed at the end of 1943 with those producing at the end of 1942.

	1942	1943
Flowing.....	16,905	16,458
Gas "kick-off".....	95	92
Gas lift.....	979	1,034
Pumping.....	7,190	7,180
Dead.....	289	309
Total.....	25,458	25,073

Cumulative oil production was 1,978,252,000 barrels.

Sixty-four salt-water injection wells were in operation in the East Texas field at the end of the year, as compared with 49 at the end of 1942. This expansion of the program of injecting salt water from the field back into Woodbine sands below the oil-water contact and a provision permitting the transfer of the allowable of wells producing more than 100 barrels of salt water per day to other wells on the same lease were of appreciable aid in maintaining bottom-hole pressures. During December of 1943, salt water was being returned to the Woodbine formation at an average rate of 305,000 barrels per day.

Fault-line fields.—There was a marked decrease in 1943 in the drilling activity which began in 1941, in an attempt to obtain additional recovery from abandoned properties in the old Woodbine fault-line fields. In the Powell field, 4 wells were completed as pumpers, producing small amounts of oil and varying quantities of salt water.

In the more recently discovered fields along this fault system, which were largely outlined by the end of 1942, completions included one small gas producer and one dry hole in the Bazette field, one gas producer in the South Groesbeck field, and one dry lower Glen Rose test in the Tehuacana field.

Grapeland (Houston County).—In the Grapeland field, 2 gas-condensate wells and 2 dry holes were drilled during 1943. At the end of the year total comple-

tions for the field were 40 gas-condensate wells and one oil well. There were four recycling plants in operation. Cumulative condensate production was 7,049,000 barrels.

Hawkins (Wood County).—A sharp decline in drilling in the Hawkins field in 1943 resulted in the completion of 30 oil wells and 9 dry holes in the Woodbine, as compared with 129 oil wells and 14 dry holes in 1942. In addition, one test which was completed in the Woodbine was classified as a gas well and closed in. One Woodbine oil well and 2 sub-Clarksville gas and condensate wells were abandoned. At the end of the year the field had a total of 403 oil wells producing from the Woodbine, of which 383 were flowing, 18 pumping, and 2 were dead. In addition to these oil wells, one Woodbine gas and condensate producer was shut in, and one well was producing gas and condensate from the sub-Clarksville sand in the upper part of the Eagle Ford formation. On December 31, 1943, the cumulative oil production was 21,228,000 barrels and condensate production about 16,000 barrels.

Kildare (Cass County).—Routine drilling operations in the Kildare field, discovered in 1942, continued through 1943, resulting in the completion of 20 oil wells, 3 gas and condensate wells, and 2 dry holes. At the end of the year there were 29 oil wells and 4 gas and condensate wells in the field. Of the oil wells, 28 were flowing and 1 pumping. All producing wells have been completed in the Rodessa zone of the lower Glen Rose.

Cumulative oil production was approximately 795,000 barrels, although this figure is known to include some condensate.

Long Lake (Anderson, Freestone and Leon counties).—No wells were drilled in the Long Lake field in 1943. One gas-condensate well was abandoned. On December 31, 1943, there were 152 oil wells and 69 gas wells producing from the Woodbine. Of the oil wells, 128 were flowing, 21 pumping and 3 were dead. There were 4 recycling plants in operation. Cumulative oil production was 7,782,000 barrels, condensate production 5,900,000 barrels.

Opelika (Henderson County).—There were no drilling operations and no abandonments in this field in 1943. At the end of the year there were 13 wells producing gas and condensate from the Rodessa zone of the lower Glen Rose. Cumulative condensate production was 4,812,000 barrels.

Pittsburg (Camp County).—Routine drilling operations resulted in the completion of 3 oil wells during 1943. At the end of the year the field had a total of 8 wells, all producing on Kobe pumps. Cumulative oil production was 281,000 barrels.

Quitman (Wood County).—The discovery well of the Quitman field was completed in December, 1942, and an active drilling campaign throughout 1943 resulted in the completion of 47 oil wells and 6 dry holes. At the end of the year the field had a total of 48 wells producing from the Paluxy formation, of which 45 were flowing and 3 pumping. No tests have been drilled in this field below the

present producing formation. Cumulative oil production was 645,000 barrels on December 31, 1943.

Talco (Franklin and Titus counties).—Thirteen oil wells were abandoned in the Talco field during 1943. No new wells were drilled. At the end of the year there were 739 producing wells, of which 5 were flowing, 711 pumping and 23 were dead. Cumulative oil production was 67,426,000 barrels.

Tri-Cities (Henderson County).—Gas and condensate production from the upper part of the Rodessa zone of the lower Glen Rose was established in the Tri-Cities field late in 1941, but no additional development occurred until 1943. During the past year, 3 additional gas-condensate wells and one dry hole were drilled. On December 31, 1943, the field had 4 producing wells. Cumulative condensate production was about 60,000 barrels.

Van (Van Zandt County).—Operations in the field in 1943 were confined to the completion of one shallow Nacatoch oil well. On December 31, 1943, there were 563 Woodbine oil wells in the field, of which 295 were flowing, 264 pumping, and 4 were dead; 2 Woodbine gas wells were shut in. There were also 3 sub-Clarksville oil wells, all pumping, and 32 Nacatoch oil wells, of which 27 were pumping and 5 were dead. Cumulative oil production from the Woodbine and sub-Clarksville was 138,527,000 barrels; from the Nacatoch, 356,000 barrels.

Wieland (Hunt County).—Only one Woodbine oil well and a dry Smackover test, discussed in detail under the section "Important Exploratory Tests," were drilled in the Wieland field during 1943. At the end of the year, the field had a total of 7 producing wells, all pumping. Cumulative oil production was about 129,000 barrels.

IMPORTANT EXPLORATORY TESTS

Bowie County.—In the northeast Bassett area in Bowie County, the P. D. Bowlen *et al.* A. L. Simms No. 1 (1)⁴ was abandoned as a dry hole, February 27, 1943, at the total depth of 8,987 feet, in the Smackover formation. The upper part of the Smackover contained porous limestone, but no showings of oil or gas were indicated. This well was located on a fault structure outlined by seismic and geological work.

Dallas County.—About 6½ miles southwest of Seagoville, in extreme southeastern Dallas County, the J. F. Lucey and S. A. Guiberson, Jr., D. H. Moyer No. 1 (2) was abandoned, January 31, 1943, as a dry hole at the total depth of 4,504 feet, after encountering metamorphosed Paleozoic rocks. The test apparently was an attempt to find oil in a pinch-out of the Smackover limestone, although no Smackover was encountered and no showings reported. The well was drilled on a block of leases farmed out by The Texas Company.

Franklin County.—In the Winfield area, 6 miles southeast of Mt. Vernon

⁴ Italic numerals in parenthesis refer to numbers in Figure 1, which indicate the locations of important exploratory tests drilled in 1943, and important active tests drilling at the close of the year.

and near the Franklin-Titus County line, the Humble Oil and Refining Company's J. F. Hague No. 1 (3), a projected Smackover test, was drilling at 9,124 feet, in upper Cotton Valley. Light brown oil stains had been encountered in slightly porous sandstones and limestones of low permeability, in the lower Glen Rose. This test is on a subsurface and seismic prospect.

Hunt County.—A Smackover test for the Wieland field, in southeastern Hunt County, the Humble Oil and Refining Company's F. F. Graham No. 1, was abandoned as a dry hole, August 9, 1943, at the total depth of 9,523 feet in the Eagle Mills salt. Cores of the upper part of the Smackover formation were moderately porous to porous limestone and dolomitic limestone, with no showings of gas or oil reported.

About $1\frac{1}{2}$ miles west of the Concord community, southwest of Greenville, Hunt County, the Humble Oil and Refining Company's J. A. Rutherford No. 1 (4) was abandoned, November 24, 1943, in Paleozoic rocks at the total depth of 7,483 feet. Approximately 200 feet of Smackover formation were penetrated, from 7,172 to 7,369 feet. The upper 40 feet contained some slightly to fairly porous oölitic, sandy limestone and calcareous sandstone, with no showings of oil or gas. Small amounts of heavy, "dead" black oil were yielded by tests of thin sand sections in the lower Glen Rose formation, through perforations in casing. This well is $3\frac{1}{2}$ miles south-southwest and almost directly downdip from the American Liberty Oil Company's J. P. McNatt No. 1, drilled the previous year, which logged only 13 feet of hard, dense, sandy limestone and calcareous sandstone in the Smackover formation from 6,662 to 6,675 feet, and was abandoned in Paleozoic rocks at the total depth of 6,896 feet.

At the end of the year, the Humble Oil and Refining Company's Lessa Norman No. 1 (5), halfway between the J. A. Rutherford No. 1 and the American Liberty Oil Company's J. P. McNatt No. 1, was coring in the lower Glen Rose sand section at 4,598 feet.

Kaufman County.—In the north Elmo area, in the northeast corner of Kaufman County, the Sun Oil Company's J. M. Rutledge No. 1 (6) was abandoned, September 28, 1943, at the total depth of 10,058 feet in the upper part of the Smackover formation, after swabbing salt water from the Smackover and through casing perforations, from two horizons in the Rodessa zone of the lower Glen Rose. This well was located near the surface trace of the North Elmo fault.

Morris County.—In the Omaha area of central Morris County the Humble Oil and Refining Company's H. N. Wright No. 1 (7) was drilling at 10,928 feet in the upper Buckner formation. The location was on a seismic prospect. This well and the Humble's No. 1 Hague, previously described, were the first wells projected as tests of the Smackover formation immediately downdip from the Mexia-Powell-Talco fault system in East Texas.

Robertson County.—In the Calvert area (8) of western Robertson County, the Magnolia Petroleum Company drilled two wells on a fault structure of the Mexia-Powell-Talco fault system. The first of these, the W. C. Anderson No. 1, was

abandoned, April 20, 1943, at the total depth of 5,196 feet in lower Fredericksburg after encountering a show of oil which yielded salt water on a drill-stem test in porous Edwards limestone, on the upthrown side of the fault. The second test, the Pauline Doremus No. 1, was structurally about 150 feet higher than the Anderson No. 1 on top of the Edwards limestone, yielded salt water on a drill-stem test of a showing of oil in the upper part of this formation, and was abandoned, July 9, 1943, at the total depth of 7,217 feet in the upper Travis Peak. Insignificant showings of oil were cored in porous zones in the Glen Rose formation.

At the end of the year, the A. G. Hill and Magnolia Petroleum Company's W. C. Anderson No. 1 was drilling at 8,500 feet as a projected Smackover test.

Smith County.—In the Sandflat area of north Smith County, the Patrick and Tyrrell Drilling Company's O. Hackett No. 1 (9) was abandoned, July 29, 1943, at the total depth of 9,852 feet, in lower Glen Rose shale above the Pettit zone. After cores in the upper Paluxy recovered about 13 feet of hard fine sand showing oil and some water sand, a 15-minute drill-stem test yielded 540 feet of 19.8° gravity black, asphalt-base oil and 630 feet of salt water.

This showing of oil resulted in additional drilling in this area. At the end of the year, the Skelly Oil Company's W. C. Chisum *et al.* No. 1 (10), 3 miles south of the Hackett well, was at the total depth of 10,011 feet, in upper Travis Peak, and was preparing to run casing to test showings of oil in the Paluxy and in the Rodessa and Pettit zones of the lower Glen Rose. Potential production from the Paluxy was indicated during the drilling of this well by a 1½-hour drill-stem test of a broken sand section from 6,972 to 7,007 feet, which recovered 6,000 feet of 24.6° gravity black, asphalt-base oil through a ¼-inch choke. Possible production from the Rodessa and Pettit zones was suggested by cutting samples and electrical log. This well was approximately 300 feet higher structurally on top of the Paluxy formation and 400 feet higher on the base of the "massive anhydrite" section of the Glen Rose than the Patrick and Tyrrell well. Near the Skelly's Chisum No. 1, the Sun Oil Company's Alice Patterson No. 1 was drilling at 5,646 feet in the Woodbine, and the Arkansas Fuel Oil Company's Priscilla Marsh No. 1 was drilling at 2,795 feet in the Nacatoch at the end of the year.

Van Zandt County.—In the north Canton area of central Van Zandt County, the Superior Oil Company's C. A. Groves No. 1 (11) was waiting on pumping equipment after swabbing 288 barrels of 36.1° gravity oil and 62.5 barrels of salt water from a sand in the upper Travis Peak, through casing perforations from 8,552 to 8,570 feet. The total depth of this well was 9,002 feet. No other showings of oil were reported in the section penetrated. This is the first well in the East Texas area to indicate possible commercial oil production from Travis Peak sands below the Pettit limestone horizon of the lower Glen Rose.

Wood County.—Following the discovery of oil production in the Coke, Quitman, and Manziel fields, two tests were drilled near the town of Alba (12), on a well known and definitely established anticlinal structure 8 miles southwest of the Quitman field in western Wood County. B. B. Orr's J. C. Rainwater No. 1,

high on the northwest flank of the anticline, was the first Paluxy test for the structure, encountered no showings of oil or gas, and was abandoned, June 11, 1943, at the total depth of 6,537 feet in the Paluxy formation. The Plains Production Company's Mitt Cox No. 1, about one mile south of the B. B. Orr test and near the crest of the structure, was awaiting abandonment at the total depth of 9,000 feet in the upper Travis Peak at the end of the year. This well also failed to encounter any significant showings of oil or gas to the depth penetrated.

In the Oak Grove area, 5 miles northeast of Quitman and 5 miles south of the Manziel field, central Wood County, Jackson and Fisher's O. M. McCarley No. 1 (13) encountered showings of heavy black, asphaltic oil in sands in the upper 300 feet of the Woodbine formation. The operators failed to make any tests of these showings and drilled to the total depth of 7,503 feet, in the Paluxy formation. No showings of oil or gas were encountered in Paluxy sands. The well was junked and abandoned, August 8, 1943, while the operators were attempting to set casing to test the showings encountered in the Woodbine.

While their McCarley No. 1 well was drilling, Jackson and Fisher began their First National Bank of Quitman No. 1 (14), which was abandoned, August 9, 1943, at the total depth of 6,016 feet, in the Woodbine. This well was 8,000 feet east of, and was 435 feet structurally lower than, McCarley No. 1, and failed to find any showings of oil in the Woodbine.

Following abandonment of their McCarley No. 1, the same operators moved the rig 177 feet northwest to drill their McCarley No. 1-A, which was abandoned, October 15, 1943, at the total depth of 5,610 feet in the Woodbine, after swabbing salt water and a little heavy black, asphaltic oil from sands in the Woodbine and in the sub-Clarksville section of the Eagle Ford.

DEVELOPMENTS IN GULF COAST OF UPPER TEXAS AND LOUISIANA IN 1943¹

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ABSTRACT

Development in the area was active and 29 new fields were discovered during 1943. Production increased over 1942 due principally to increased allowables for previously completed wells. No new geologic trends were opened to production during the year. Routine development and extensions provided more reserve values than new discoveries.

INTRODUCTION

The Gulf Coast province of upper Texas and Louisiana is considered to extend from Matagorda County, Texas, eastward along the Gulf of Mexico across Texas and southern Louisiana to the Mississippi state line. The northern boundary extends from Brazos County, Texas, to Avoyelles Parish, Louisiana.

The area embraced ranges from the down dip Wilcox and Cockfield of Eocene age, the Vicksburg and *Marginulina*-Frio section of Oligocene age, and the undifferentiated Miocene.

Wildcat drilling in the area declined: 153 wildcats were drilled in 1943 as compared with 164 in 1942. Discoveries increased: 29 new fields were found during the year as compared with 22 for 1942. Of these 8 were from the Miocene, 12 from the Oligocene, 4 from the Cockfield, 1 from the Reklaw, 4 from the Wilcox. Thirteen are classed as oil fields, 3 as gas fields, and 13 as gas-condensate fields. Practically all discoveries may be attributed to the seismograph.

Production increased but principally on account of increased allowables from wells drilled in prior years.

TEXAS

Tables I and II present the pertinent data concerning Texas discoveries.

TABLE I
TEXAS FIELDS DISCOVERED IN 1943

Field Name	County	Operator	Producing Formation	Total Depth (Feet)	Producing Depth (Feet)	Initial Production (Barrels)
1 Chesterville	Colorado	Magnolia Petrol. Co.	Yegua	12,011	6,850-60	44, 53° dist.
2 Cistern	Fayette	Continental O. Co.	Wilcox	4,498	9,500-40	88, 51° dist.
3 Citrus Grove	Matagorda	Continental O. Co.	Reklaw	1,187-91	55	
4 Cottonwood	Liberty	Wm. Helis	Miocene	6,555	3,980-90	Dry gas
5 Jacksons Pasture	Chambers	Mayo et al.	Frio	8,205	7,704-10	92
6 North Katy	Waller	Stanolind O. & G.	Frio	8,000	8,102-08	90 dist.
7 Kirby	Liberty	General Crude	Yegua	9,518	6,622-25	154
8 Menefee	Wharton	Salt Dome O. Co.	Yegua		8,400-30	768
9 North Louise	Wharton	Continental O. Co.	Frio	5,523	4,540-30	Dry gas
10 Pinchurst	Montgomery	LaGloria O. Corp.	Frio	11,921	4,163-66½	Gas
			Wilcox		3,760-66	320
11 Ramsey	Colorado	Cities Service	Wilcox	10,505	9,700-26	120 dist.
					8,320-40	100 dist.
12 Sugar Valley	Matagorda	Superior O. Co.	Frio	11,854	8,948-70	94 dist.
					9,754-39	132 dist.

¹ Presented by title before the Association at Dallas, March 22-23, 1944. Manuscript received, April 3, 1944.

² Gulf Oil Corporation, P.O. Box 2100. Acknowledgment is made to W. H. Hough of the Gulf Oil Corporation, who assisted greatly in preparation of the Texas data.

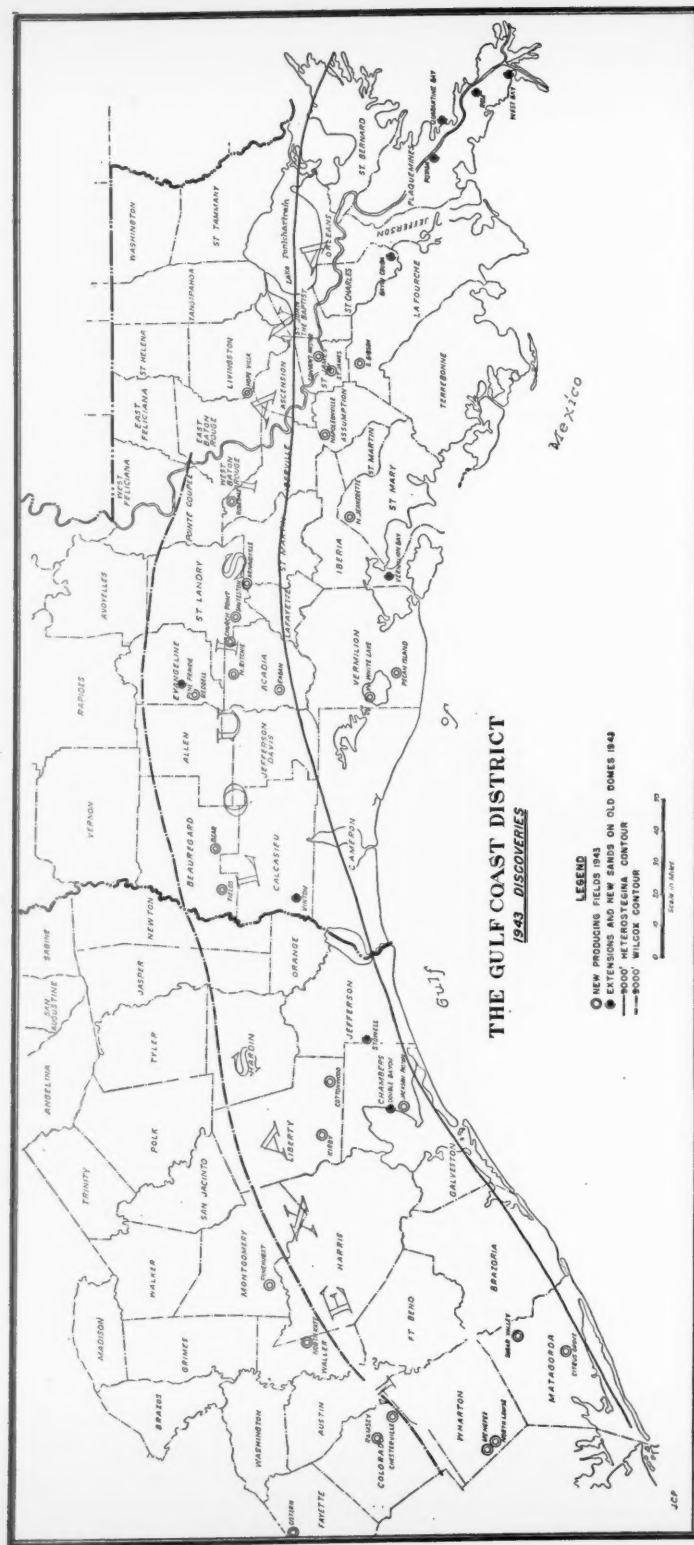


FIG. 1

TABLE II
GEOLOGIC DISTRIBUTION OF 1943 DISCOVERIES IN GULF COAST OF UPPER TEXAS

	<i>Oil</i>	<i>Gas</i>	<i>Distillate</i>	<i>Total</i>
Miocene		1		1
Oligocene	1	1	2	4
Yegua	2		1	3
Reklaw	1			1
Wilcox			3	3
	—	—	—	—
	4	2	6	12

The discovery of oil in the Yegua section on the north flank of the Katy structure appears worthy of comment as a large area may be involved in the oil production. The area had previously indicated only gas-condensate values.

Yegua production on the southwest flank of Esperson dome in Liberty County, which was discovered during the year, appears to be worthwhile as a number of satisfactory producers were completed during the year.

At Pinehurst in Montgomery County a multiple-sand Wilcox field with both oil and gas condensate production may prove an important discovery.

EXTENSIONS AND NEW SANDS

The outstanding extension of the year was that at Stowell, Jefferson County. Development resulted in numerous dually completed Frio wells and as many as four oil sands were found in certain parts of the field. Reserves were rapidly increased and Stowell may now be classed as a major coastal oil field. In the north or recently developed part of the field oil is produced on the upthrown side of a large fault at right angles to regional strike. Such fault patterns in the past have not been considered favorably and this feature of the Stowell field will likely lead to exploration in similar areas in the Frio trend.

At Double Bayou, Chambers County, a Frio sand indicated a high condensate yield comparable with that of Lake Creek in the Wilcox, and this may stimulate development in certain distillate areas which have heretofore been considered marginal.

Several attempts were made during the year to ascertain sand conditions in the downdip Frio along the coast but results are inconclusive although the development of the Humble Oil and Refining Company at Hall's Bayou indicates sufficient sand section to warrant further explorations of prospects in this immediate area.

The first triple completion in the United States was made in three zones in the Wilcox by the Superior Oil and Gas Company in the Lake Creek Field in Montgomery County.

At Reddell in Evangeline Parish production is indicated from both the Yegua and Wilcox. As development is at a preliminary stage no estimate of the area involved may be made at this time but the multiple zones give promise of a worthwhile field.

LOUISIANA

DISCOVERIES

Tables III and IV present the 1943 discoveries in Louisiana.

TABLE III
LOUISIANA FIELDS DISCOVERED IN 1943

Field Name	Parish	Operator	Producing Formation	Total Depth (Feet)	Producing Depth (Feet)	Initial Prod. Bbls. per Day
1 Arnaudville	St. Martin	Amerada Pet. Corp.	Oligocene	10,700	10,349-78	70 dist.
2 Bear	Beauregard	General Crude O. Co.	Oligocene	9,412	6,512-20	151
3 Church Point	Acadia	Amerada Pet. Corp.	Oligocene	10,302	10,316-53	149 dist.
4 Convent Hester	St. James	Humble O. & R. Co.	Miocene	7,602	5,342-45	91
5 East Gibson	Terrebonne	Falcon Seaboard <i>et al.</i>	Miocene	10,600	9,280-90	220
6 Eagan	Acadia	Sun Oil Co.	Oligocene	11,200	10,610-25	105 dist.
7 Fields	Beauregard	Sohio Pet. Co.	Yegua	10,911	8,011-20	182 dist.
8 Hope Villa	E. Baton Rouge	Shamrock Oil Co.	Oligocene	9,874	9,568-75	208
9 Napoleonville	Assumption	Geo. H. Echols	Miocene	10,474	9,034-38	192
10 North Jeanerette	St. Marys	Atlantic O. & R. Co.	Miocene	12,211	11,453-58	292
11 North Richie	Acadia	Continental O. Co.	Oligocene	9,909	8,580-91	71
12 Pecan Island	Vermillion	Humble O. & R. Co.	Miocene	12,057	10,847-53	10 dist.
13 Reddell	Evangeline	Danciger <i>et al.</i>	Wilcox	12,206	9,905-55	358 dist.
14 Rosedale	Iberville	Sugarfield Oil Co.	Oligocene	10,533	10,009-12	215
15 Shuteston	St. Landry	Sun Oil Co.	Oligocene	11,505	9,494-9,505	146
16 St. James	St. James	Humble O. & R. Co.	Miocene	10,895	10,763-85	96 dist.
17 West White Lake	Vermillion	Union Oil of Calif.	Miocene	12,001	8,356-75	Dry gas

TABLE IV
GEOLOGIC DISTRIBUTION OF 1943 DISCOVERIES IN COASTAL LOUISIANA

	Oil	Gas	Distillate	Total
Miocene	4	1	2	7
Oligocene	5	0	3	8
Yegua	0	0	1	1
Wilcox	0	0	1	1
	9	1	7	17

Most discoveries are still one-well fields and, with the exception of the Bear field in Beauregard Parish which is unimportant, little may be said at this time regarding the importance of the 1943 discoveries.

EXTENSIONS AND NEW SANDS

On the north flank of the old Vinton dome in Calcasieu Parish the Union Oil Company of California has developed Frio production which is favorably comparable with the most prolific flank sand production around any piercement salt dome. Some wells have encountered in excess of 400 feet of oil sand. The productive area is complicated by faulting.

At the West Bay field in Plaquemines Parish the Gulf Refining Company encountered salt in several wells at depths ranging from 9,130 to 10,005 feet. This deeper drilling has uncovered new Miocene sands which indicate the field may be both larger in area and more prolific than early development promised.

Extensions were developed at Quarantine Bay, Grand Bay, Potash, and Rose dome, all in Plaquemines Parish, which add considerably to the reserve picture.

Although the Pine Prairie field was one of the most active in the area, results as a whole were disappointing as the Sparta sand section in some places was thin and tight, and low recoveries per acre must be expected. The Wilcox section also

has low permeability and the depth of this production, 10,000-10,600 feet, makes operators proceed cautiously. The west flank of the dome offers the most promise for worthwhile Wilcox production.

At Bayou Couba, St. Charles Parish, three excellent Miocene producers were completed but the area involved is small and at present the field is of minor importance.

At Vermillion Bay dome, Iberia Parish, development by The Texas Company resulted in production beneath salt and cap-rock overhang. Overhang up to 3,000 feet in thickness was drilled at depths between 5,500 and 8,500 feet and oil was produced from 9,500 to 10,900 feet.

DEVELOPMENTS IN SOUTH TEXAS IN 1943¹

WM. H. SPICE, JR.²

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ABSTRACT

In 1943 continued curtailment of development in South Texas was due to lack of skilled labor, equipment, and material, and decreased transportation facilities. This resulted in a decrease in wells drilled, new fields discovered, and oil wells completed as compared with 1942.

Total oil production was increased by about 40 per cent, reflecting a heavier withdrawal rate from the fully developed fields.

The Frio-Vicksburg trend contributed 40 per cent of the new discoveries, the Wilcox trend 33 per cent, and the Jackson-Yegua trend 27 per cent. Exploration showed an increase in deeper drilling and more extensive work in the south part of the district.

INTRODUCTION

The South Texas area embraces 61 counties which are covered by the Railroad Commission of Texas Oil and Gas Division's Districts 1, 3, and 4. Forty-two of these counties are producing oil and gas. However, because of the large size of this group of districts, the entire area has been divided into stratigraphic divisions or trends based on geologic age.

These trends were previously suggested by Kidd.³

1. The Ordovician and Pennsylvanian of the Edwards Plateau
2. The Cretaceous of the Balcones fault zone
3. The Wilcox to Sparta in the lower Eocene
4. The Yegua and Jackson in the upper Eocene
5. The Frio-Vicksburg of basal Oligocene age
6. The upper Oligocene and lower Miocene of the coastal area, including the *Marginulina*-Frio, Catahoula, and Oakville

These trends remain essentially the same as used in former papers and no attempt is made here for further definition.

DEVELOPMENT

During 1943, 25 new oil fields and 10 new gas or gas-distillate fields were discovered in South Texas. In addition, new producing sands were discovered in 22 fields. Table I lists the new discoveries and Figure 1 shows the location of new discoveries and deeper horizons and extensions.

Both exploratory wells and field wells drilled during the year showed a decrease of more than 10 per cent under the previous year. Eleven hundred wells of all classes were drilled. Of these, 328 exploratory wells were dry, and of the 740 wells drilled in proved fields, 482 were oil wells, 66 were gas-distillate wells, and 192 were dry holes. The decrease under 1942 in new fields discovered was about

¹ Presented by title before the Association at Dallas, March 22-23, 1944. Manuscript received, April 13, 1944.

² Consulting geologist, Alamo National Building. Acknowledgment is made to companies and individuals for their assistance in furnishing many of the data used in this paper.

³ Gentry Kidd, "Developments in South Texas, 1938-1939," *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 23, No. 6 (June, 1939), pp. 860-70.

TABLE I
SOUTH TEXAS FIELDS DISCOVERED IN 1943

County and Field	Type	Completion Date	Discovery Well	Survey	Depth of Production Formation	Initial Production (Bbls. per Day)	Choke (Frac. of Inches)	Gravity	Producing Formation
Be: Blanton	Oil	8-23-43	Pure Oil Co., Tom Williams 1	Michael O'Donnell	4,953	55	10/64	25	Frio-Vicksburg
Be: Cosen, West	Oil	12-24-43	H. B. Zachry Co., Phillip Brown et al 1	T. J. Butler	3,659	38	1/8	44	Vega-Jackson
Be: Cosen-Wilcox	Gas-distillate	8-18-43	MacKinnon Petr. Co., J. M. Freeland 1	John Pace, Ab-247	7,300	3 MCFG & spray	1/4	52	Wilcox
Be: Mineral	Oil	3-13-43	Dicks Bros., C. S. Page Est. 2	T. K. Pilkington	7,460	{130 bbls. & est. 3 MCFG	1/4	56	Wilcox
Be: Tynan	Oil	1-1-43	Stanford O. & G. Co., Ludvika Ulke 1	Hiram H. Williams	4,107	46 net oil	5/32	23	Vicksburg
Duval: Clara	Oil	9-20-43	Stanford O. & G. Co., Clara Driscoll 2	S. K. N. O. 6, Ab-1106	3,708	10 net oil	Pumping	25	Vega-Jackson
Duval: Strake	Dual	2-20-43	Geo. W. Strake, Ira G. Yates Est. 1	S.A.M.G. 1, Ab-526	{45 gal. hor. & 31,642 gal. hor.	8 MCFG & 10 net oil	Jetting	44	Vega-Jackson
Goliad: Cabeza Creek	Oil	3-1-43	Atlantic Refig. & Continental Oil Cos., Jessie E. Pettus 1	Sebastian Vela	7,645	{1,072 MCFG & 38 distl.	3/16	25	Wilcox
Goliad: Cabeza-Wilcox	Oil	5-20-43	Continental Oil Co., Mrs. Ada S. Wood 1-W	C.E.P.I.&M. Co.	7,600	232	5/32	36	Wilcox
Goliad: Terrell Point	Oil	12-20-43	Fred W. Shield, Edna Terrell 1	Antonio Siedeck	4,650	156	5/32	34	Frio
Goliad: Little Kentucky	Oil	10-17-43	W. L. Pickens, John Kramer 1	Morris-Cummings 34	5,700	140	7/64	35	Frio
Jackson: Sterling	Gas	5-17-43	W. Stewart Boyle et al., M. D. Levy 1	Morris-Cummings 5	4,830	{13.5 MCFG & spray oil	Open 2"	—	Frio
Jim Hogg: Armstrong	Oil	6-28-43	The Texas Company, Louis Armstrong 1	S.K.&K. 99, Ab-307	3,247	20 1/4	1/8	38	Vega-Jackson
Jim Hogg: Weil	Oil	2-18-43	Sun Oil Company, Weil Bros. 3	Palitos Blancos Gr.	5,062	8 net oil	20 1/4	45	Vega-Jackson
Jim Hogg: Yeager	Oil	6-16-43	Massingill et al., R. R. Yeager et al. 1	H.&G.N. 29	3,923	67	1/4	36	Vega-Jackson
Jim Wells: Magnolia City, N.	Oil	6-10-43	Humble Oil & Refig. Co., M. A. Evetts 1	Marcelino Lopez Gr.	5,260	121	1/8	35	Frio-Vicksburg
Jim Wells: Wilson	Gas-distillate	5-12-43	Sam E. Wilson, Maria S. de Garza 1-A	Ramon de la Garza	7,920	{Est. 100 MCFG & 130 distl.	open	?	Vicksburg
Karnes: Burnell-Wilcox	Gas-distillate	1-29-43	American Liberty Oil, Otto Von Roeder 1-W	Jas. Johnson, Ab-164	6,743	{Est. 3.5 MCFG & 58 distl.	3/16	54	Wilcox
Karnes: Hobson	Oil	3-16-43	Seaboard Oil Co. of Dela, Julia Rzeppa 1	Don Erasmo Seguin	4,000	93	1/8	32	Wilcox
Karnes: Honda Creek	Oil	3-2-43	Phillips Petr. et al., C. L. V. Reasoner 1	Carlos Martinez	6,582	175	1/4	49	Wilcox
Karnes: Porter	Oil	5-17-43	Westwestern Oil Co., H. T. Sellers 1	Victor Blanco, Ab-3	4,108	{Est. -0.68 MCFG & 38 oil	13/64	49	Vega-Jackson
Karnes: Porter, North	Oil	6-18-43	Cox & Hamon, Ben Johnson 1	Victor Blanco Gr.	3,990	68	1/8	40	Vega-Jackson
Karnes: Runge	Oil	12-9-43	Arkansas Fuel Oil Co., E. Lyons 1	D. C. Lyons Jr.	6,598	137	3/4	38	Wilcox
Live Oak: Coquat	Oil	9-21-43	Henderson Coquat, Mrs. Minerva Coquat 1	J. Potevent 1	7,402	32	3/16	49	Wilcox
Live Oak: Goebel	Dual	7-1-43	Henderson Coquat, Walter W. Goebel 1	Refugio C.S.L. 6	{6,003 distl. hor. & 1,650 oil hor.	{31 & 19	3/16	{51 (high) & 38 (high)	Wilcox
Nueces: Violet	Gas-distillate	3-22-43	Phillips Petr. Co., Wm. Heurmann 1	Chas. Land 412	7,195	{Est. .645 MC FG & 18 distl.	1/8	55	Frio
Refugio: Inari	Gas	5-9-43	Pat R. Rutherford, G. A. Huff 1	Edward Perry, Ab-48	5,035	Est. 3 MCFG	3/16	—	Frio
Refugio: La Rosa, North San Patricio: O'Neil	Gas-distillate	12-24-43	John T. Rutherford, Joe Weiss 1	Esteren Lopez Gr.	6,180	91	1/8	50	Frio
Starr: Cameron	Oil	5-8-43	John T. O'Neil, Jas. F. Welder Hrs. 1	Tates-Villareal	6,828	{2.23 MCFG & 52 distl.	3/16	57	Frio
Starr: Lockhart	Oil	8-27-43	Continental Oil Co., Wm. I. Cameron 1	Geo. W. Smith 138	4,120	26	3/16	45	Vega-Jackson
Starr: Lockhart	Oil	3-20-43	Lockhart & Daymont, E. P. Caffarelli 1	Porcion 80	3,620	77	1/8	48	Frio-Vicksburg
Starr: Ross	Oil	6-18-43	Goldstein et al., Alberto Gutierrez 1	Porcion 88	2,845	1	1/8	26	Vega-Jackson
Starr: Hartman	Gas	8-31-43	The Texas Company, Bert Hartman 2	Samuel Hamilton	1,938	.87 MCFG	1/8	26	Vega-Jackson

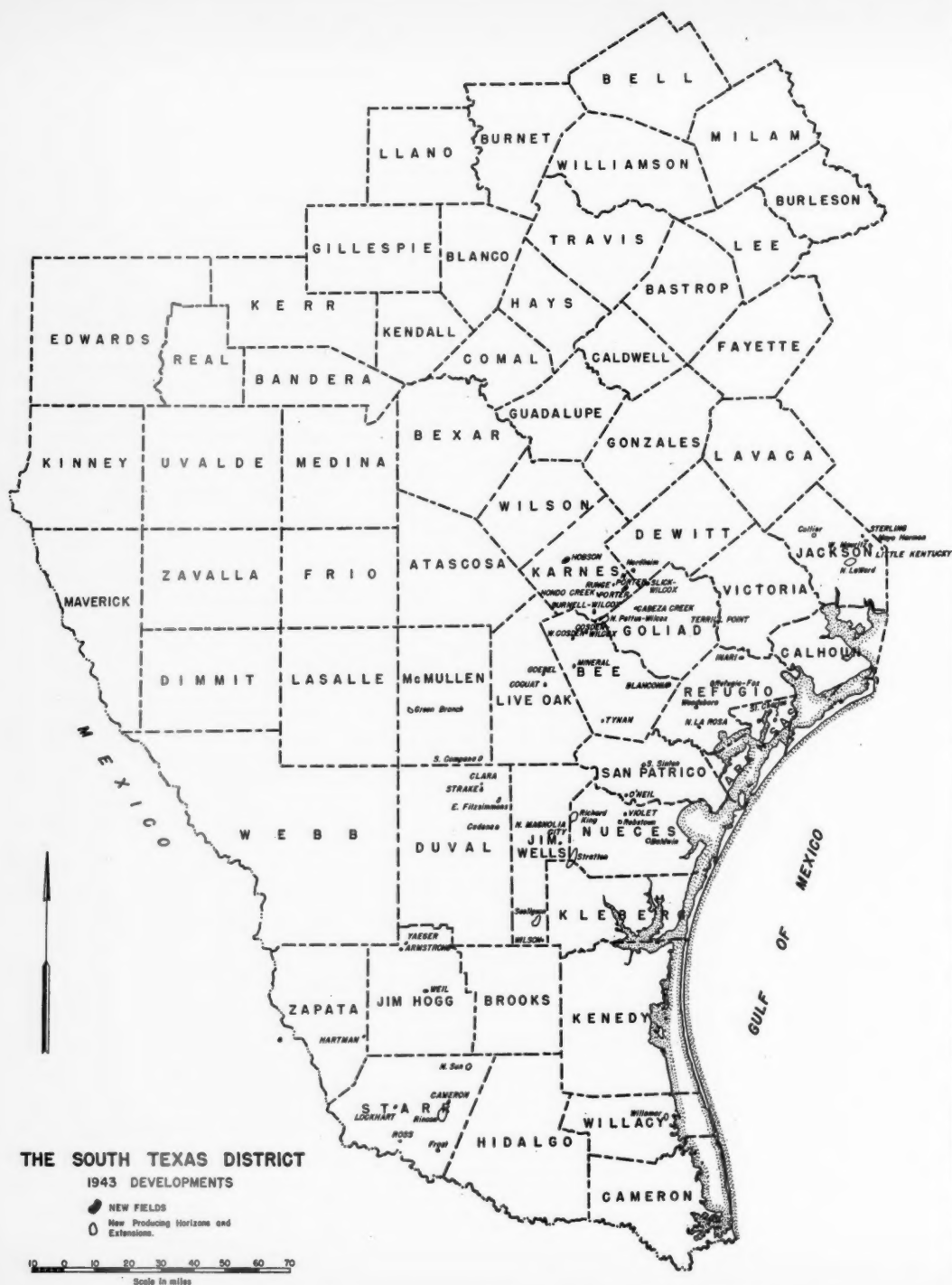


FIG. 1. Location of new discoveries, deeper horizons and extensions in South Texas in 1943.

15 per cent and in total oil wells completed was more than 20 per cent. This is a continuation of the trend started during 1942.

Lack of skilled labor, equipment and material, and decreased transportation facilities, together with governmental regulations, forced a curtailment of the active development of proved leases and also resulted in less exploration. Toward the latter part of the year, participation of capital not normally engaged in the oil industry resulted in more exploratory wells being drilled than would have been the case under more normal conditions. The limit of this year-end surge in exploratory work was determined by the number of available drilling rigs and the lack of first-class exploratory prospects.

PRODUCTION

The total oil production in 1943 was approximately 103,300,000 barrels, an increase of more than 40 per cent over 1942. This oil production from approximately 15,000 wells represents a heavier withdrawal rate from many of the fully developed fields and reflects the improved transportation facilities both by pipe lines and tankers, over the conditions of 1942.

EDWARDS PLATEAU

No new developments were carried on in this area. High drilling costs and lack of transportation facilities make this area less desirable during a period of curtailment of exploratory work.

CRETACEOUS—FAULT LINE

No discoveries were made during the year along this trend although the Edwards limestone fields represent one of the most prolific producing zones in South Texas. Further development was carried on by the Humble Oil and Refining Company in the Imogene field of Atascosa County, where the deepest Edwards limestone oil (7,500–7,600 feet) is found along the fault line.

WILCOX TREND

Continuing the activity started during the previous year, 7 new oil fields and 4 new gas-distillate fields were discovered along this trend. They extend from Karnes County to La Salle County and represent about 33 per cent of the total discoveries of the district. New producing sands were also discovered in two fields in this trend.

The Slick-Wilcox field of Goliad and DeWitt counties was of major importance. The discovery well, the Continental Oil Company's Mrs. Ada S. Wood 1-W, was completed in May, producing from the second sand zone in the Carrizo-Wilcox from 7,600 to 7,650 feet. This discovery is on a faulted dome which had previously been developed for shallower Pettus sand production with poor results.

The discovery of the Hobson field in Karnes County by the Seaboard Oil

Company of Delaware's Julia Rzeppa No. 1, completed in March from the top of the Carrizo-Wilcox at 4,000 feet, was also of importance since it established the shallower part of the present Wilcox trend. This discovery led to considerable leasing and additional exploratory activity along this trend.

The Goebel and Coquat fields near Oakville in Live Oak County, discovered by Henderson Coquat's Walter W. Goebel No. 1 in July and Mrs. Minerva Coquat No. 1 in September, were the result of extensive geophysical work along the Oakville fault area. The first well was a dual completion: gas-distillate in the second Wilcox (Luling) sand at 6,900 feet and oil in the third Wilcox (Slick) sand at 7,050 feet. The other well was completed as a gas-distillate well in the upper Wilcox at 7,462 feet.

YEGUA-JACKSON TREND

The Yegua-Jackson trend contributed 9 new oil fields and one new gas field, or 27 per cent of the total discoveries of the district. These fields extend from Karnes County to Starr County. New producing sands were discovered in three fields along this trend.

The three fields discovered in Jim Hogg County—the Weil field in March, the Yaeger field in June, and the Armstrong field in September—represent new exploratory work along this trend with the producing sands occurring from 3,247 to 5,002 feet.

The Porter field in Karnes County, discovered in May, 1943, is a faulted type of structure producing from the Pettus sand at 3,990 feet.

The one gas field discovered in this trend was the Hartman field in Zapata County, producing gas from the Cole sand at 1,938 feet.

FRIO-VICKSBURG TREND

Exploratory drilling along the Frio-Vicksburg trend was the most successful during the year from the standpoint of discoveries. Seven oil fields and 6 gas-distillate fields were discovered. They extend from Jackson County to Starr County and represent 40 per cent of the discoveries of the district. New producing sands were discovered in 13 fields in this trend.

Although Jackson County was the most active area in this trend during the previous year, only one new oil field, Little Kentucky, and one new gas field, Sterling, were discovered in 1943. However, in four fields in this county, new producing formations were discovered.

The Cameron field in Starr County, discovered in August by the Continental Oil Company's Cameron No. 1, about 2 miles north of the Rincon field, is an important discovery. Completed in the Frio sand at 4,140 feet, the discovery well tested five other sands in the Frio section all of which showed oil or gas.

Of the gas-distillate fields discovered along this trend, the Wilson field, discovered in April by Sam E. Wilson, Jr., Maria de Garza No. 1-A, 3 miles east

of La Gloria field, may become important. This well was completed in Vicksburg sand at 7,920 feet.

UPPER OLIGOCENE AND LOWER MIOCENE

No discoveries were made in the upper Oligocene and lower Miocene trend, although new producing sands were found in 3 fields.

EXPLORATORY METHODS

Discoveries in this district are credited to either subsurface geology or geophysical investigation, or a combination of both. The total number of exploratory parties working in the district decreased from 40 in January, 1943, to 31 in December, 1943. At the end of the year, these parties were divided as follows: seismograph, 22; gravitimeter, 5; core drill, 3; and electrical experimental unit, 1.

TREND IN EXPLORATION AND DEVELOPMENT

During the year, the trend in exploration and development has been definitely toward deeper drilling and more extensive exploratory work particularly in the south part of the district, in all formations from the Frio-Vicksburg down through the Wilcox.

PETROLEUM DEVELOPMENTS IN CANADA IN 1943¹

G. S. HUME²

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ABSTRACT

The most important development in Canada in 1940 was the exploration and drilling under the Canol project, resulting in the outlining of a major oil field in the Mackenzie River area, 75 miles south of the Arctic Circle. On the plains of Alberta, progress has been marked in the development of the Taber and Vermilion oil fields, and renewed activity leading to further oil discoveries has been made in the Athabaska and Lloydminster areas. In the foothills drilling has shown Devonian is not present above the major fault which underlies the central part of Turner Valley, and in the Jumping-pound area where the east edge of the Paleozoic in a fault block was outlined by a seismic survey, a deep well has confirmed the presence of the limestone, but oil was not present in it.

INTRODUCTION

Active areas for exploration and development in Canada for 1943 include the Mackenzie River area of the Northwest Territories, particularly the Norman Wells field, 75 miles south of the Arctic Circle, and various areas in the Prairie Provinces of Western Canada, as follows: Turner Valley in the foothills southwest of Calgary, Taber on the plains 30 miles east of Lethbridge, Vermilion 130 miles southeast of Edmonton, and a number of wildcat wells in other districts of Alberta, and in southwestern Saskatchewan. In Eastern Canada the only significant wildcat locations are one well in the Gulf of St. Lawrence to test a structure outlined by seismic surveys on Prince Edward Island and in Hillsborough Bay 7 miles from Charlottetown, and a further well to test the prospects of Gaspé, Quebec, where seepages have long been known.

NORMAN WELLS AREA

The Norman Wells field (Fig. 1) was discovered by the Imperial Oil Company in 1920, and for many years has supplied oil to a local refinery for local requirements. As a war necessity the field has now been developed under the Canol project inaugurated in 1942 by arrangements between the United States and Canadian Governments with the Imperial Oil Company Limited. Previous to the Canol development the Imperial Oil Company had four producing oil wells on the northeast bank of Mackenzie River, about 50 miles northwest of Fort Norman, and a refinery capable of processing about 840 barrels of crude oil a day. Operations were mainly confined to the summer months. Under the Canol project Imperial Oil Company undertook the development of the Norman Wells field and certain exploratory surveys, and the United States army undertook the building of a pipe line 600 miles, from Norman Wells to Whitehorse, Yukon, and the building of a refinery at Whitehorse.

The development of the Norman Wells field has exceeded expectations with

¹ Presented by title before the Association at Dallas, March 22-23, 1944. Manuscript received, April 6, 1944.

² Geologist for the Oil Controller for Canada.

the result that a major oil field has been developed. This has largely been outlined as the result of wells drilled in 1942 and 1943, and it is now considered the field

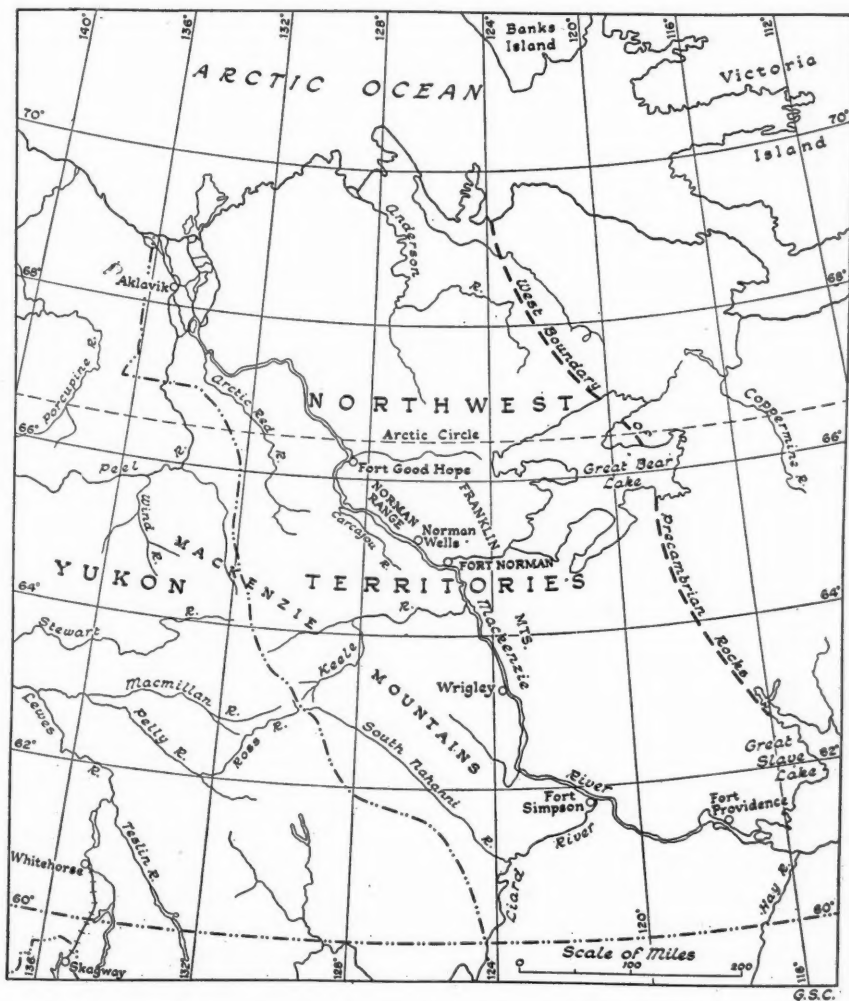


FIG. 1.—Northwest Territories showing Norman Wells oil area.

contains 4,000–5,000 acres in part on the northeast bank of Mackenzie River, and in part on Bear and Goose islands in the river, $1\frac{1}{4}$ – $1\frac{1}{2}$ miles from the northeast bank. Thus, a considerable part of the field is under the river. No wells have been

found on the southwest side of the river, but only one well was drilled in that area in 1943. Within the Norman Wells field 12 wells were drilled in 1943, and of these 10 were productive, and the other two on the edges of the producing area.

At Norman Wells the regional structure is a basin about 20 miles wide, between the Norman Range on the east and the Mackenzie Mountains on the west. The Norman Range is anticlinal, and Silurian strata crop out on it. On its flank on the southwest the succession of beds is as follows: Middle Devonian limestones, Upper Devonian dark shales, Upper Devonian greenish sandstones and shales, Cretaceous sandstones and shales with Cretaceous dark shales in the central part of the basin. The Norman Wells field is on the southwest dip of approximately 5° in the vicinity of the producing area. The oil occurs in a reef limestone in Upper Devonian beds. The age of the reef was formerly regarded as possibly Middle Devonian, but it is now known there are dark shales presumably Upper Devonian in age under the reef limestone. The age thus seems to be definitely Upper Devonian. The thickness of the reef is variable up to, and greater than 400 feet and the seal for the oil on the northeast is provided by the disappearance of the reef limestone updip. The wells in the upper end of the reef are 1,000-1,100 feet deep to the top of the producing zone, and on Bear and Goose islands the deepest wells within the productive zone reach it at about 2,000 feet in depth.

The oil from the Norman Wells field has a paraffine base, a gravity of about 38° A.P.I. and a very low pour point.

The production of the Norman Wells field in 1943 was for local use, and for the testing of the wells. The pipe line was not completed at the end of the year, but construction was well under way.

TURNER VALLEY, ALBERTA

Turner Valley (Fig. 2), in the foothills southwest of Calgary, still continues to be the largest producing oil field in Canada. Production reached a peak in February, 1942, and is now declining. In order to keep up the production as far as possible Wartime Oils Limited, a Crown company, was formed in 1943, and is lending money to small independent companies at a low rate of interest, and a small royalty, to drill wells in an area known to have low production prospects. The money will be paid back out of production when this is obtained. Of 21 active wells at the end of 1943, eight were sponsored by Wartime Oils. During 1943 three Wartime wells and 23 other wells were successfully completed in Turner Valley. One well drilled on the east side to a depth of 10,230 feet was suspended without obtaining production.

Two major structural features of Turner Valley were brought to light by the drilling in 1943. The first was the extent and gentle attitude of the overthrust fault underlying Turner Valley, and reached a depth of 8,795 feet in the Devonian test drilled as a joint project of a number of companies on the west flank of the central part of the field. As the name implies, this well was an attempt to reach Devonian strata under Turner Valley. After drilling 1,555 feet of Mississippian

limestones and calcareous shales, the well faulted back into the upper part of the Lower Cretaceous beds, indicating a stratigraphic break of approximately 2,500

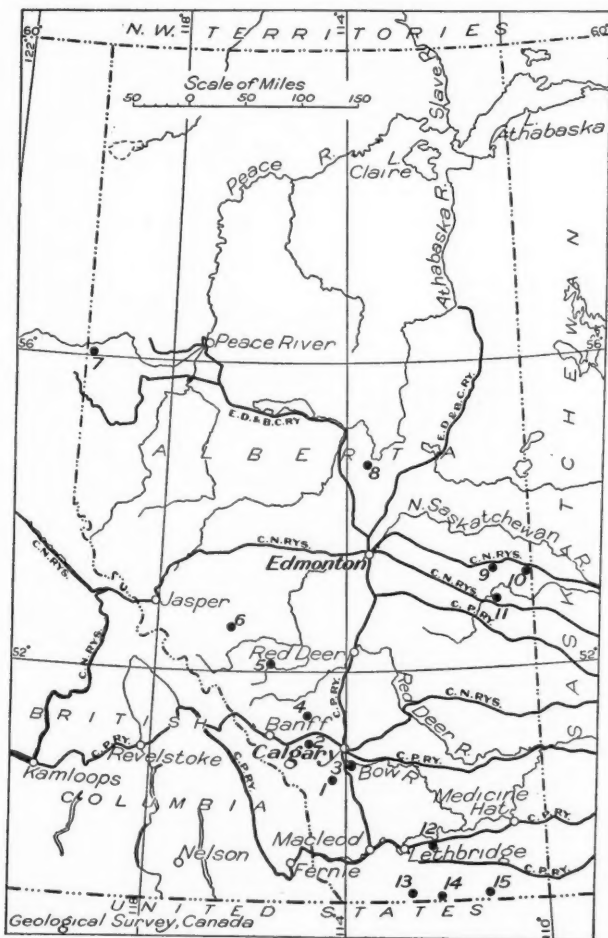


FIG. 2.—Oil fields and prospects in Alberta. (1), Turner Valley; (2), Jumpingpound; (3), Aldersyde; (4), Wildcat Hills; (5), Ram River; (6), Nordegg; (7), Pouce Coupé; (8), Athabasca; (9), Vermilion; (10), Lloydminster; (11), Wainwright; (12), Taber; (13), Del Bonita; (14), Red Coulee; (15), Pinhorn.

feet. The well was plugged back to the porous zones in the upper part of the Mississippian limestone where it was put on production.

The other major structural feature definitely established in 1943 was the presence on the east flank in the north end of the field of a fault block at lower

WILDCAT WELLS IN CANADA AT END OF 1943

	Name of Well	Location				Depth (Feet)	Formation Reached	Results (to end of 1943)
		Lsd.	Sec.	Tp.	Rge.			
FOOTHILLS	ALBERTA							
	Imperial Nordlegg	12	30	40	16	2,803	Cretaceous	Abandoned
	Rain River 2	8	12	37	18	4,856	Palaeozoic	Some gas; abandoned
	Walton Creek	3	12	37	18	4,856	Cretaceous	Abandoned
	Wildcat Hills	10	30	27	5	9,722	Upper Cretaceous	Drilling
	Okalta Morley					2,730	Cretaceous	Abandoned
	Shell Norman (Jumping pound)	5	22	24	5	12,956	Mississippian	Drilling
	Dome 3 (Moose Mountain)	17	17	22	6	2,830	Palaeozoic	Some gas; abandoned
	Sullivan Creek	13	25	17	5	3,590	Palaeozoic	Abandoned
	Royal Sun	2	17	13	3	2,753	Faulted from Pal. to Blairmore at 2,431 ft.	Abandoned
	Maxmont	12	20	0	2	9,650	Blairmore	Drilling
	Arrow Marlon	12	12	0	2	377	Blairmore	Drilling
	Peace-Coupe-Peace River area						Cretaceous	5,000 Mcf. gas
	Alaska Highway	16	22	80	13	2,173	Cretaceous	Abandoned
	Oil and Gas						Lower Cretaceous	15,000 Mcf. gas
PLAINS	Althabasca area							
	Deca 2	1	4	66	22	1,380	Lower Cretaceous	Abandoned
		3	10	66	23	1,684	Lower Cretaceous	Oil
		2	15	66	23	1,644	Lower Cretaceous	Oil
	East Central Alberta							
	Lloydminster area							
	Sparky 1	8	32	40	1	1,989	Lower Cretaceous	Oil
		5	33	40	1	1,986	Lower Cretaceous	Drilling
	Shaw 2	3	35	40	1	1,987	Lower Cretaceous	Oil
	Red Star 1	12	11	30	1		Lower Cretaceous	Oil
	Wainwright-Vermilion area							
	Rancho 1	14	34	47	6	2,048	Lower Cretaceous	Abandoned
	Apex	9	22	49	6	1,983	Lower Cretaceous	Not finished
	Edgerton 1	1	19	43	4	2,863	Lower Cretaceous	Showings of oil; abandoned
	Inland Oil and Gas	5	20	45	7		Lower Cretaceous	Drilling
	Kinsella-Viking area							
	General Petroleum, Kinsella 1	16	29	44	8	1,075	Lower Cretaceous	Gas
		13	11	40	15	2,450	Lower Cretaceous	Abandoned
	Blackleaf 1	1	29	44	9	2,480	Cretaceous	Abandoned
	Anglo Kinsella 1	16	12	46	12	2,278	Cretaceous	Abandoned
	Imperial Viking 1	5	20	47	13	2,835	Devonian	Abandoned
		1	15	47	14	2,847	Devonian	Abandoned
		3	29	45	12	2,789	Devonian	Suspended
	Kinsella Phillips 3	4	4	49	14	2,501	Lower Cretaceous	Abandoned

In addition, seven successful gas wells were drilled in the Kinsella gas field.

WILDCAT WELLS IN CANADA AT END OF 1943—Continued

Name of Well	Location				Depth (Feet)	Formation Reached	Results (to end of 1943)
	Lsd.	Sec.	Tp.	Rce.			
Southern Alberta							
Imperial Clancy 1	7	8	0	16	4	Mississippian	Abandoned
Imperial Clancy 2	13	1	0	16	4	Jurassic	Abandoned
Noble	14	10	0	16	4	Jurassic	Abandoned
Chin Province	14	33	8	17	4	Drilling	Drilling
Wrentham Province	13	11	8	18	4	Mississippian	Abandoned
Midcontinent 1	13	11	8	18	4	Mississippian	Abandoned
Midcontinent 3	10	12	6	17	4	Mississippian	Abandoned
Lion Taber 1	8	1	8	17	4	Drilling	Drilling
Lion Taber 1	8	22	7	15	4	Drilling	Drilling
Blood Indian Reserve							
Imperial Blood Indian Reserve 1	10	31	5	23	4	Mississippian	Abandoned
Other wells in Southern Alberta							
Imperial Armelgra 1	6	10	13	13	4	Jurassic	Oil
Imperial Grantham	1	20	13	15	4	Mississippian	Abandoned
Imperial Grassy Lake	13	35	10	13	4	Mississippian	Drilling
Imperial Erickson Coulee 1	6	7	1	12	4	Mississippian	Abandoned
Ross Lake 1	4	17	2	22	4	Mississippian	Abandoned
McCall Frontenac	6	8	1	8	4	Drilling	Drilling
Pinhorn 1	8	21	1	20	4	Drilling	Drilling
Trans Alberta	15	19	20	1	4	Devonian	Abandoned
Alliance Alberta	15	1	21	26	4	Blairmore	Drilling
Shell McWilliams	8	34	19	29	4	Blairmore	Drilling
New Ranchmen's Snider (Aldersyde area)	10	34	19	29	4	Blairmore	Drilling
SASKATCHEWAN							
Norcanols Dahinda	10	23	10	23	2	Paleozoic	Abandoned
Norcanols Ogena	4	24	7	23	2	Paleozoic	Drilling
Norcanols Parry	16	8	9	21	2	Paleozoic	Drilling
Boundary Horsham 1	10	26	17	29	3	Paleozoic	Oil showings
Twin Provinces 1	21	11	11	20	2	Jurassic or Paleozoic	Suspended
Simpson 3	7	22	28	25	2	Drilling	Drilling
PRINCE EDWARD ISLAND							
Island Development 1 in Hillsborough Bay						Drilling	Drilling
QUEBEC							
Continental Petroleum Limited 1, Galt anticline						Drilling	Drilling

elevation than the main uplift. The discovery was made by Northwest Hudson Bay well No. 13. This well reached the top of the Paleozoic limestone at a depth of 7,240 feet (at an elevation of -3,189 feet), and at 7,790 feet faulted back into Lower Cretaceous beds after drilling part of the productive porous limestone beds. The well again reached the top of the productive limestone at a depth of 9,012 feet (-4,951 feet) and was completed at 9,435 through both porous zones. The bottom of the hole, however, is somewhat off the vertical, so the vertical depth is somewhat less. The well found production both above and below the fault. The significance of this appears to be that the faulting which thrust the main mass of Turner Valley over the east side fault block occurred after the oil accumulation, and that the oil was carried down with the east side fault block as it was depressed. On the west flank of the north end of Turner Valley, oil occurred in the upper porous zone, and salt water in the lower porous zone of the limestone in a well reaching the top of the limestone at an elevation of -4,587 feet. Thus the oil-water line in the east side fault block is several hundred feet deeper than on the west flank of the main uplift.

It is impossible, at present, to evaluate the importance of the deep east side fault block. Another well, $\frac{1}{4}$ mile east of Northwest Hudson Bay No. 13, reached the top of the Paleozoic limestone on the same fault block at an elevation of -4,936 feet. At the end of 1943 this well was drilling in the limestone. It has been finished subsequently with oil in both porous zones. It shows the fault block at this place is more than $\frac{1}{4}$ mile wide, and that it is only very gently tilted westward. At a minimum at least, a few hundred acres have been proved and semi-proved by these wells and the area could be of considerable extent and importance.

In the main uplift of Turner Valley the remarkable amount of closure, more than 5,000 feet within the productive gas and oil zones of the Paleozoic limestone, has been commented on elsewhere. The oil-water line, however, seems lower on the ends of the field than in general along the west flank of the structure. On account of this fact the north end of the field was still farther extended in 1943, and the north limits have not yet been defined.

At the end of 1943 there were 214 limestone zone oil wells, 32 limestone zone gas wells, and 3 shallow wells in production in Turner Valley. All wells flow. The production of the field for 1943 including crude oil and natural gasoline recovered was 9,452,697 barrels, a decrease of 551,238 barrels from 1942. It is likely that the decline will continue in 1944, as only a limited number of attractive sites still remain undrilled. The wells drilled under the sponsorship of Wartime Oils Limited can only partly offset this decline, and by the end of 1944 Wartime Oils will have finished or be close to completion of all presently projected wells.

TABER FIELD: SOUTHERN ALBERTA PLAINS

The Taber oil field is 30 miles east of Lethbridge. It was discovered by Plains well No. 2, drilled in 1937, but the present development by Dominion Oil Com-

pany, a subsidiary of the Standard Oil Company of California, seems to be an entirely separate producing area. The discovery well of Dominion Oil Company was completed in 1942, and was followed in that year by the drilling of three other dry holes. In 1943 the Dominion Oil Company drilled 3 productive and 2 unsuccessful wells, and one well was drilling at the end of the year. Three other wells in proximity to the field were dry. Thus at the end of 1943 in the Taber field there were 4 productive wells owned by Dominion Oil Company, in addition to Plains well No. 2 which may be on a separate producing area. The depth of the wells is 3,100-3,200 feet. All wells are pumped.

The oil in the Taber area occurs in a sand at the base of the Lower Cretaceous on the northwest flank of the north plunging Sweetgrass arch. The trend of the field appears to be in a northeast instead of northwest direction as first anticipated. Thus, although the conditions in the field are those of a stratigraphic trap, there undoubtedly are other structural and sedimentary conditions that control the trend.

The proved area outlined by drilling in the Taber field to the end of 1943 was 200 acres with a width of $\frac{1}{2}$ mile. The oil from the Dominion wells has a gravity of 18°-20° A.P.I., whereas that from Plains well No. 2 is 26° A.P.I. The field seems capable of a very considerable extension, but at present the outlet is restricted by the lack of satisfactory and adequate refining facilities to handle this type of crude oil.

VERMILION FIELD: EAST CENTRAL ALBERTA

The Vermilion field was discovered in 1939. The productive sand is 130-140 feet below the top of the Lower Cretaceous at a depth of approximately 1,850 feet. The structure of the field is very flat, and the oil sand is thin with water close below the oil. The result is that much difficulty has been experienced with water and the oil produced by pumping contains some emulsion and fine silt. An electrical dehydration (Petresco) unit capable of handling 1,000 barrels a day was installed in this field late in 1943, and some of the wells are now being provided with electrical pumping equipment.

A great impetus to drilling in the Vermilion field was given by the entry in 1943 of Cannar Oils, a subsidiary of Canadian National Railways, in order that fuel oil would be provided for the mountain divisions of this railroad. In 1943 Cannar Oils drilled 27 wells, of which 21 were productive. In addition 12 other wells were drilled, of which 6 were successfully completed.

The amount of proved oil land in the field at the end of 1943 was approximately 600 acres. The spacing is one well to 10 acres. At the end of 1943, 29 wells were on production, and the yield for the year was 93,258 barrels. The oil has a gravity of 14° A.P.I. and the clean oil is used directly for fuel without topping.

DEL BONITA: SOUTHERN ALBERTA

The Del Bonita structure is a subsidiary anticline on the Sweetgrass arch.

It is on a trend which includes the Ross Lake, Spring Couleé, and Blood Indian Reserve folds. The regional plunge is toward the north, and as Del Bonita is toward the south, close to the International Boundary, it is the highest part of this trend in Canada. It has been mapped by seismic surveys. The Terminal well completed in 1936 found some oil and has yielded oil at a low rate. In 1943 a further well, Del Bonita No. 1, was drilled. This found some oil in the top of the Mississippian limestone which was reached at a depth of 5,035 feet. The oil is about 36° A.P.I. The well is not yet on steady production.

This discovery has led to renewed activity in this area, and other wells will be drilled.

LLOYDMINSTER

Some renewed activity took place near Lloydminster in Alberta near the Saskatchewan boundary in 1943. Four wells have been drilled, and all have encountered some heavy oil in Lower Cretaceous sands. None of the wells is on steady production.

ATHABASKA

In the area near the town of Athabaska in a well drilled in 1934 some heavy oil was encountered in a sand in the Grand Rapids formation of Lower Cretaceous age at a depth of 1,650 feet. This oil was never produced. In 1943 interest was revived in this area, and one well encountered oil, and one a very considerable volume of gas in the same producing sand. It is likely further drilling will be done.

FOOTHILLS STRUCTURES

The drilling of a deep well on the west flank of central Turner Valley has shown that the Devonian is not present above the major fault which underlies this structure. This information is valuable in interpreting foothills structures. Also a well in the Jumpingpound area of the foothills has reached the Paleozoic limestone at a depth of 11,588 feet in a fault block where seismic surveys indicated limestone would be found. The fact that oil was not present was disappointing, but from the results obtained there is hope that it will be possible in the faulted and structurally complicated foothills to indicate by geophysical means the presence of limestone fault masses at reasonable depths. The foothills contain sufficient outcrops to outline the major structural features, but up to the present it has not been possible to predict the conditions at depth with any degree of accuracy owing to the low angles of many fault planes and the fact that the faults cut off many structures above the possible productive formations. If the limestone masses can be detected by geophysical means, as has been done at Jumpingpound, a new phase of development will take place in the foothills.

GEOLOGICAL NOTES

VIOLA GRAPTOLITES FROM WELL-CORE EAST OF NORMAN, OKLAHOMA¹

CHARLES E. DECKER²

Norman, Oklahoma

The Phillips Petroleum Company well Goodin 1 (Sec. 33, T. 9 N., R. 1 E.) was cored at 6,398-6,402 feet, and graptolites were found in the 4-foot zone, but those best preserved were practically at the 6,400-foot depth. James H. Durham and A. J. Montgomery, geologists for the Phillips Company, supplied the graptolites for identification, and gave permission to publish information in regard to them.

As shown in the illustrations, three different genera are represented. While numerous graptolites occur in the fossiliferous zone, many of them are duplicates.

In the class Graptolithina these forms all belong to the order Graptoloidea. They are listed and described in order from simple to more complex.

Dicellograptus forchammeri flexuosus Lapworth (Fig. 1)

Diplograptus vespertinus Ruedemann (Fig. 2)

Climacograptus bicornis (Hall) (Fig. 3)

Dicellograptus forchammeri flexuosus Lapworth

Plate 1, Figure 1

While only three thecae of the rhabdosome, or stipe, are preserved, because of their great length, the form is assigned to the variety *flexuosus*. Typically the two stipes diverging from the central sicula at a large angle, later bend toward one another until they almost meet distally, forming a large pincer-like colony 14 centimeters or more in length.

In the regular species, the thecae range in number from 8 to 10 in 10 millimeters, while in this specimen they are 1.25 mm. long and occur 6 to 7 in 10 mm. The width is 0.7 mm. The position in preservation is such that the ordinary condition of introversion of the apertural end of the thecae is not shown. The apertural excavations occupy nearly half the width of the stipe. Three narrow elongate bithecae occur on this fragment in a manner which the writer has recently shown to be common on a number of species in this genus.

This variety *flexuosus* occurs widespread in the lower part of the Viola limestone in the Arbuckle Mountains of Oklahoma. The distribution is shown by the writer in a previously published article.³

An almost complete colony of this variety was collected south of Sulphur 2 miles west of Nebo store. The basal part of this specimen was illustrated by Ruedemann and Decker.⁴

The variety *flexuosus* occurs in southern Scotland where it has a more limited range than the species, *D. forchammeri*. The fragment shown in Figure 1 is similar to one shown in text-figure 95c by Elles and Wood.⁵ They give a long description of the species *D.*

¹ Manuscript received, April 17, 1944.

² Research professor in paleontology, University of Oklahoma.

³ Charles E. Decker, "The Viola Limestone, primarily of the Arbuckle and Wichita Mountain Regions, Oklahoma," *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 17 (1933), pp. 1405-35, Table 3, and detailed measured sections.

⁴ Rudolf Ruedemann and Charles E. Decker, "The Graptolites of the Viola Limestone," *Jour. Paleon.*, Vol. 8 (1934), p. 307, Pl. 40, Fig. 11.

⁵ Gertrude Elles and Ethel M. R. Wood (Mrs. Shakespear), "Monograph of British Graptolites," *Paleontographical Society of London* (1901-1918), p. 152, text-Figs. 95a-d, Pl. 22, Figs. 2a-d.

forchammeri and clearly differentiate the variety *flexuosus* and illustrate the latter with four text-figures and with large parts of four colonies on the plate.

Diplograptus vespertinus Ruedemann

Figure 2

Described first by Ruedemann⁶ as a variety of *Diplograptus foliaceus*, the varietal name *vespertinus* was raised to the rank of a species by Ruedemann and Decker.⁷

Described briefly, the length of the stipes varies from 15 to 42 mm., but few of the longer forms remain unbroken. The width varies from 1 mm. proximally to 2.5 mm.

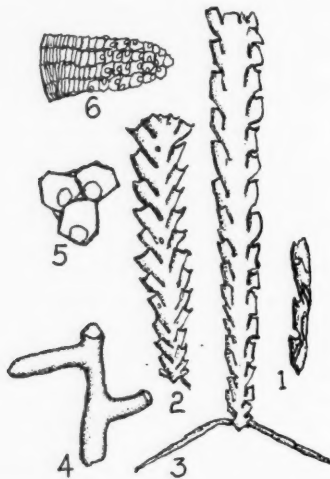


PLATE I

FIG. 1.—Side and partially apertural view of 3 thecae *Dicellograptus forchammeri flexuosus* Lapworth. $\times 4$.

FIG. 2.—Side view of *Diplograptus vespertinus* Ruedemann. $\times 4$.

FIG. 3.—Side view *Climacograptus bicornis* (Hall). $\times 4$.

FIG. 4.—Side view *Monotrypa multitabulata* Loeblich. $\times \frac{1}{2}$.

FIG. 5.—Transverse section across 3 zoecia. $\times 20$.

FIG. 6.—Small segment of transverse section of *Monotrypa multitabulata*. $\times 8$. (All from core of Phillips' Goodin well No. 1.)

distally. The widening is attained in 15 mm. Thecae number 11 to 13 in 10 mm., and occur at angles of 30° – 40° . The overlap is a little more than one-third their length.

Diplograptus vespertinus is common and widespread in the lower part of the Viola limestone as *D. recurrens* is in the middle and upper part.

It occurs in New York in the Upper Ordovician Snake Hill beds with *Cryptograptus tricornis* which occurs also in the lower part of the Viola and in the Stringtown and Womble shales.

⁶ Rudolf Ruedemann, "Graptolites of New York," Part 2, *New York State Museum Mem.* 11 (1908), p. 352, text-Figs. 296–98, Pl. 25, Figs. 4, 5.

⁷ Rudolf Ruedemann and Charles E. Decker, *op. cit.*, p. 317.

Climacograptus bicornis (Hall)

Figure 3

This is one of the very common and best known species of *Climacograptus*. It is particularly noteworthy because of its two long slender lateral spines on the sicular end of the stipe.

Named and described first by Hall⁸ from the Normanskill shale near Albany, New York, one hundred years ago, it was described in greater detail by Ruedemann,⁹ and illustrated by text-figures and on plate. Also he discussed in great detail the development of the two proximal spines, and gave a table showing the relation of the simple spined form to those on which alations on the spines developed into floats. In addition, he gave a list of 35 references for the species.

It is a typical *Climacograptus* in which the thecae have a double bend, and their outer margins become parallel with the axis of the stipe. They may attain a length of 100 mm. or more. The proximal width is 1 mm., and it increases to 2.6 mm. in 30 mm. Thecae number 12 in 10 mm. proximally, and 7 in 10 mm. in the mature part. The proximal spines may attain a length of more than 4 mm.

With all the extensive collecting, this species has been found in only one locality in the Viola limestone, yet 75 miles northeast it occurs in that formation at a depth of 6,400 feet. It occurs in the Stringtown and Womble shales of eastern Oklahoma and Arkansas, in the Normanskill shale of eastern New York, and northward into Quebec and New Brunswick. It is found abundant at many localities in the Glenkiln shales in Great Britain with *Nemagraptus gracilis* with which it occurs in America. It occurs in Scandinavia and in many localities in Victoria, Australia.

Thus it is seen how widely this graptolite zone in the Viola limestone may be correlated with Upper Ordovician formations in this and other countries.

Immediately beneath the graptolite zone in the core there occurs 3 feet of green calcareous shale which contains bryozoa and brachiopoda. A side view of the bryozoan is shown in Figure 4 and parts of a thin section are shown in Figures 5 and 6. This form is shown to be a typical upper Simpson species. *Homotrypa multitabulata* Loeblich described and illustrated by Loeblich.¹⁰

This diagnostic bryozoan fixes the age of the green shales as Bromide, and the 45 feet of dense limestones below it are thought also to belong to the Bromide.

⁸ James Hall, "Graptolites of the Utica Slate and Hudson River Group," *Paleon. of New York*, Vol. 1 (1843), p. 268, Pl. 73, Figs. 2a-s.

⁹ Rudolf Ruedemann, *op. cit.* (1908), pp. 433-37, text-Figs. 404, 405, Pls. A and 28, Figs. 24-26.

¹⁰ A. R. Loeblich, "Bryozoa from the Ordovician Bromide Formation, Oklahoma," *Jour. Paleon.*, Vol. 16 (1942), p. 421, Pl. 63, Figs. 1-3.

FREE OIL IN AMMONITES, COLOMBIA, SOUTH AMERICA¹

T. J. ETHERINGTON²

San Francisco, California

In the Cretaceous section of Colombia free oil has been noted in various parts of the stratigraphic section, but the most striking occurrence is in the *Oxytropidoceras* zone of the middle Albian.

This zone is abundantly fossiliferous, especially in limestone concretions interbedded in dark gray shales. No evidence of oil can be detected on the outside of the concretions, but, when they are broken with a hammer, free oil can be obtained from the hollow central

¹ Manuscript received, April 24, 1944.

² Standard Oil Company of California.

part of the individual chambers of the ammonites. These chambers are completely separated both by the septa and a layer of secondary calcite which lines each chamber. As much as $\frac{1}{2}$ teaspoon of light green oil has been found in the larger chambers.

This zone is known to extend over an area of 120 miles by 40 miles in the upper Magdalena Valley on both sides of the Magdalena Basin. In isolated areas near Simiti a similar condition is present, but the ammonites are lower Albian in age.

Isolated occurrences in the upper Magdalena Valley are in the Turonian but there the concretions are associated with highly petroliferous shale.

REVIEWS AND NEW PUBLICATIONS

* Subjects indicated by asterisk are in the Association library, and are available, for loan, to members and associates.

REVIEW OF PETROLEUM GEOLOGY IN 1943, BY F. M. VAN TUYL *ET AL.*

REVIEW BY JOHN L. FERGUSON¹

Tulsa, Oklahoma

"Review of Petroleum Geology in 1943," by F. M. Van Tuyl and members of the departments of geology, geophysics and petroleum engineering of the Colorado School of Mines. *Colorado School of Mines Quar.*, Vol. 39, No. 2 (April, 1944). 127 pp., including table of contents, abstract, introduction, bibliography, and four illustrations. Price, \$1.00.

The second annual review of petroleum geology, prepared by the faculty of the Colorado School of Mines for the research committee of the American Association of Petroleum Geologists, was presented in part at the Dallas meeting of the Association and has now been published. Dr. Van Tuyl was able to read only a short synopsis of the review at the meeting, for it has almost doubled in size over the review presented last year.

The scope of the report has been somewhat extended but the additional size has been caused by the more comprehensive coverage of certain items, particularly the bibliography. The bibliography of 27 pages is subdivided similarly to the text, and makes a handy reference to the literature of petroleum geology and allied sciences published in 1943.

In the text the section heads are titled as follows: Important Events of the Year, Advances in Petroleum Geology and Allied Subjects, Aerial Photographs, Miscellaneous New and Improved Techniques, Noteworthy Discoveries (of petroleum deposits), Production and Reserves, and Trends in Petroleum Geology and Geophysics. Under these headings are mentioned practically every scientific contribution, development, technique, and news event of petroleum geology which has been reported in 1943. Several sections cover their subject in great detail, paleontology in particular, and most of the coverage is adequate. However, it is certain that the aim of all the reported activities of the petroleum geologist and his co-workers is toward the discovery of new oil fields. Therefore, the section of the review entitled "Noteworthy Discoveries" should cover more thoroughly the discoveries of new oil and gas deposits as such. Possibly it might be desirable to reduce the length of some of the quoted material elsewhere in order to include these additional data.

I consider the preparation of these reviews one of the most useful activities of the research committee and Dr. Van Tuyl and his associates should be highly commended for the exhaustive and all-inclusive survey they have made of all branches of activity which concern petroleum geology. These annual volumes serve as ready references to the advances being made in searching for and producing new supplies of oil and gas, and the well-indexed bibliographies give instant access to the full discussion of new information.

¹ Amerada Petroleum Corporation. Review received, May 6, 1944.

GEOLOGY AND GROUND WATER RESOURCES OF CIMARRON COUNTY, OKLAHOMA, BY STUART L. SCHOFF AND J. WILLIS STOVALL

REVIEW BY RONALD K. DEFORD¹

Midland, Texas

"Geology and Ground Water Resources of Cimarron County, Oklahoma," by Stuart L. Schoff, geologist of the United States Geological Survey, with a Section on Mesozoic

¹ Argo Oil Corporation. Review received May 12, 1944.

Stratigraphy by J. Willis Stovall, professor of geology, University of Oklahoma. *Oklahoma Geol. Survey Bull. 64* (Norman, Oklahoma, 1943). Paper, 6×9 inches, 317 pp., 27 figs., frontispiece, 23 pls. (2 in pocket), table of contents, 24 tables. Price, \$0.80.

Bulletin 64, which supersedes *Bulletin 34*,² provides the accurate account of the geology of Cimarron County that has long been needed. The introduction, geography, and general geology are by Schoff; the stratigraphy of the Triassic, Jurassic, and Cretaceous systems is by Stovall, of the Tertiary and older Pleistocene by Schoff, of the Pleistocene and Recent by Stovall and Schoff with a chapter on "Basketmaker Culture in the Oklahoma Panhandle" by Forrest E. Clements, former professor of anthropology at the University of Oklahoma. The final section on ground-water resources is by Schoff; this, with Appendix B, "Logs of Wells," and Appendix C, "Tables of Records of Wells and Springs," occupies 168 pages or more than half the book. Appendix A, "Measured Stratigraphic Sections in Cimarron County," 17 pages, is by Schoff and Stovall.

Bulletin 64 has no index. To add one would be an improvement. Thinner bulletins published by the Kansas and New Mexico State surveys, for example, have useful indexes.

Of the two folded maps (in black and white patterns, not colored) in the back pocket, Plate I, "Map of Cimarron County, Oklahoma, Showing Geology and Depths to Water in Wells," generalizes the areal geology of the county in terms of the Triassic, Jurassic, Cretaceous, Tertiary systems, Quaternary dune sand, and stream deposits. Its contours directly record the *depth* to water and are supplemented by local notations such as "erratic water in redbeds" and "depth to water in Cimarron Valley 5 to 150 feet." This map can be read and used by the farmer and water-well driller without the need of any technical advice; it makes hydrologic information directly available to those who most need and use it. Plate II, "Geologic Map of Northwestern Part of Cimarron County," shows the areal geology in terms of formations.

The Triassic age of all pre-Exeter formations is established by the discovery of phytosaur remains. All the Triassic formations are assigned to the Dockum group.

Bulletin 64 cites with approval Heaton's correlation³ of the Exeter sandstone with the Entrada. Goldman and Merwin⁴ concur. The maps in *Professional Paper 183*⁵ that show the eastern limit of the Entrada sandstone in western and central Colorado are probably wrong.

At Inscription Rock and Zuni in northwestern New Mexico⁶ the Morrison formation grades into a remarkable, marginal sandstone facies, then disappears. The same thing happens in southern Quay County, northeastern New Mexico. It is relatively easy to trace the Exeter sandstone southward from Cimarron County into northern Quay County. Careful work in the vicinity of Tucumcari, New Mexico, would show the relation of the Exeter (Entrada) to the marginal sandstone facies of the Morrison and to a shaly limestone bearing plentiful Jurassic fish remains.

² E. P. Rothrock, "Geology of Cimarron County, Oklahoma," *Oklahoma Geol. Survey Bull. 34* (October, 1925).

³ Ross L. Heaton, "Contribution to the Jurassic Stratigraphy of Rocky Mountain Region," *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 23, No. 8 (August, 1939), Fig. 7, p. 1166.

⁴ Marcus I. Goldman and Arthur C. Spencer, "Correlation of Cross' La Plata Sandstone, Southwestern Colorado," *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 25, No. 9 (September, 1941), pp. 1762-65.

⁵ A. A. Baker, C. H. Dane, and J. B. Reeside, Jr., "Correlation of the Jurassic Formations of Parts of Utah, Arizona, New Mexico, and Colorado," *U. S. Geol. Survey Prof. Paper 183* (1936), Fig. 12, p. 49, and Fig. 15, p. 52.

⁶ Baker, Dane, and Reeside, *op. cit.*, pp. 9, 17, 43-44; Fig. 14, p. 51; Fig. 16, p. 55.

The reviewer takes satisfaction in the fact that *Bulletin 64* confirms his 2-page geologic note⁷ published in 1927.

Schoff's discussion of the "Ogallala" formation and its caliches is pertinent to the High Plains country as far south as Midland, Texas.

⁷ Ronald K. DeFord, "Areal Geology of Cimarron County, Oklahoma," *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 11, No. 7 (August, 1927), pp. 753-55.

RECENT PUBLICATIONS

CANADA

"Petroleum Possibilities in Mackenzie River Valley, N.W.T.," by J. S. Stewart. *Trans. Canadian Inst. Min. and Metallurgy*, Vol. 47 (1944). 20 pp., 4 figs., 4 photographs, and tables. Address: 906 Drummond Building, Montreal, Canada.

*"Geology and Development of the Norman Wells Oil Field," by J. S. Stewart. *Oil and Gas Jour.*, Vol. 42, No. 51 (Tulsa, April 27, 1944), pp. 136, 138. Digest of preceding article. Original article was given at the annual general meeting of the Canadian Institute of Mining and Metallurgy, at Toronto, March, 1944.

CUBA

*"New Foraminiferal Genera from the Cuban Middle Eocene," by W. Storrs Cole and Pedro J. Bermudez. *Bulletins Amer. Paleon.*, Vol. 28, No. 113 (Paleontological Research Institution, Ithaca, New York, May 4, 1944). 20 pp., 3 pls.

GENERAL

*"Notes on Eocene Gastropods, Chiefly Claibornian," by Katherine VanWinkle Palmer. *Bulletins of American Paleontology*, Vol. 28, No. 112 (Paleontological Research Institute, Ithaca, New York, April 19, 1944). 26 pp., 2 pls.

*"The Type Section of the Aquitanian," by J. Wyatt Durham. *Amer. Jour. Sci.*, Vol. 242, No. 5 (New Haven, Connecticut, May, 1944), pp. 246-50.

MISSISSIPPI

*"The Heidelberg Oil Field," by William Clifford Morse, *Oil*, Vol. 4, No. 3 (New Orleans, Louisiana, April, 1944), pp. 7-8; 1 map, 1 log.

*"Exploration Spreading in Mississippi Oil Prospects," by William Clifford Morse. *Oil and Gas Jour.*, Vol. 42, No. 52 (Tulsa, May 4, 1944), pp. 30 and 116; 1 map.

MONTANA

"List of Tests for Oil and Gas in Montana," by C. E. Erdmann and N. A. Davis. *U. S. Geol. Survey* (May, 1944). Mimeographed tabular information about 200 wells, mostly wildcats. Obtainable, free, from U. S. Geological Survey, Washington, D. C.; Room 305, Federal Building, Casper, Wyoming; Room 335, Federal Building, Billings, Montana; Room 225, Federal Building, Great Falls, Montana; Room 414, Denham Building, Denver, Colorado.

OHIO

*"The Geological Section at the Limestone Mine, Barberton, Ohio," by Clinton R. Stauffer. *Amer. Jour. Sci.*, Vol. 242, No. 5 (New Haven, Connecticut, May, 1944), pp. 251-71; 1 fig., 1 pl.

PALESTINE

*"Structure and Evolution of Palestine, with Comparative Notes on Neighboring Countries," by Leo Picard, *Bull. Geol. Dept. Hebrew Univ.*, Vol. 4, Nos. 2-3-4 (Jerusalem, 1943). 134 pp., 18 figs.

PENNSYLVANIA

*"Gravity Investigation of Central-Eastern Pennsylvania," by J. B. Hersey. *Bull. Geol. Soc. America*, Vol. 55, No. 4 (New York, April, 1944), pp. 417-44; 4 pls., 9 figs.

TEXAS

*"Exploratory Water-Well Drilling in the Houston District, Texas," by Nicholas A. Rose, W. N. White, and Penn Livingston. *Texas State Board of Water Engineers* (June, 1943). 41 mimeographed pp., 10 figs. Prepared in coöperation with the U. S. Dept. of the Interior, Geological Survey, and the City of Houston. Available from W. N. White, district engineer, Ground Water Division, U. S. Geol. Survey, Austin, Texas.

*"Progress Report on the Ground-Water Resources of the Texas City Area, Texas," by N. A. Rose. *U. S. Geol. Survey* (November 15, 1943). 49 mimeographed pp., 3 figs., 1 chart. Prepared in coöperation with the Texas State Board of Water Engineers. Available from W. N. White, Ground Water Division, U. S. Geol. Survey, Austin, Texas. No charge.

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BIBLIOGRAPHY OF GEOLOGY EXCLUSIVE OF NORTH AMERICA

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36. Handbook of Physical Constants. Edited by Francis Birch, *Chairman*, J. F. Schairer, and H. Cecil Spicer. 1942. 325 pp., 19 tables. Price, \$1.40.
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WEST TEXAS GEOLOGICAL SOCIETY

STUDENT MERIT AWARD

Maisie I. Coon is the recipient of the 1944 West Texas Geological Society Student Merit Award. Miss Coon is a graduate of Texas Technological College, and a resident of Lubbock, Texas. The West Texas Society gives her a 2-year associate membership in the A.A.P.G., and the Association presents her with a clothbound volume of the *A.A.P.G. Bulletin*, Volume 27 (1943).

MAISIE I. COON.—Born in Stafford, Oklahoma, April 2, 1921. Moved to Lubbock,

Texas, at age of 3 years. Attended grade school and high school in Lubbock; attended Texas Technological College at Lubbock from 1939 to 1942. In September, 1942, through January, 1944, worked as computer and did some geological work with the Stanolind Oil



MAISIE I. COON

and Gas Company of Fort Worth, Texas. Returned to college in January, 1944, to get degree in geology (completing 40 semester hours of geology.) While attending college, was employed part-time with the Klaus Exploration Company of Lubbock assisting in geophysical and geological work.

Resides at 604 Avenue S, Lubbock, Texas.

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The executive committee arranges the Association membership into geographic districts so that the members may elect district representatives on the business committee. This is in accordance with Article V of the by-laws.

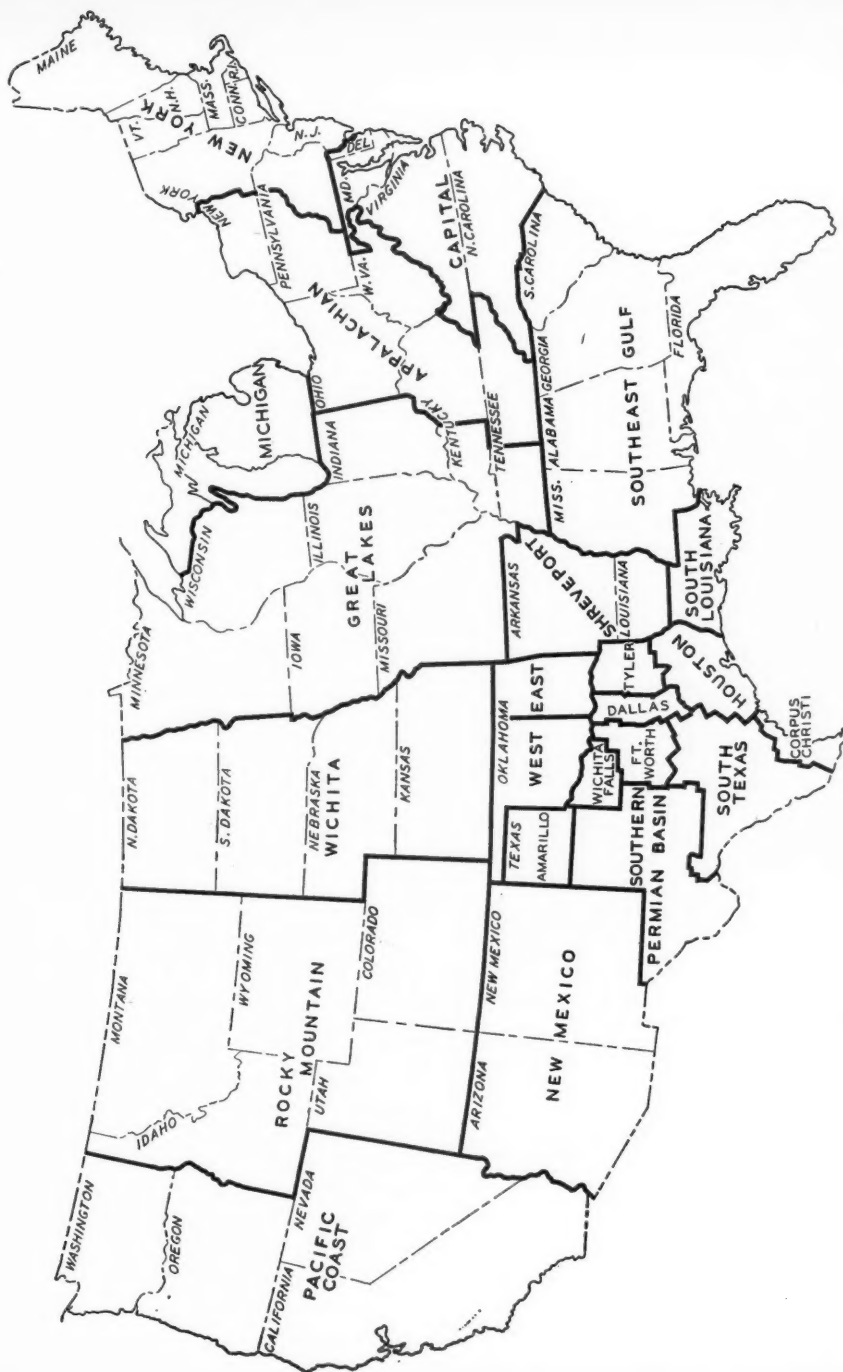
ARTICLE V. DISTRICT REPRESENTATIVES

The executive committee shall cause to be elected district representatives from districts which it shall define by a local geographic grouping of the membership. Such districts shall be redesignated and redefined by the executive committee as often as seems advisable. Each district shall be entitled to one representative for each seventy-five members, but this shall not deprive any designated district of at least one representative. The representatives so apportioned shall be chosen from the membership of the district by a written ballot arranged by the executive committee. They shall hold office for two years, their term of office expiring at the close of the annual meeting.

At present (June, 1944) there are 25 districts, 23 of which are in the United States (Fig. 1), and one comprises Canada, and one South America.

Each district has at least one representative, elected by the individual members (full members, not associate members) residing in the district. This representative thus becomes a member of the Association business committee, which acts "as a council and advisory board to the executive committee and the Association."

In each district, with few exceptions, there is an organized geological society; in a few districts there are two or three societies. The "local" society is not an organized part of the A.A.P.G.; it is independent and self-governing. Usually, the society was organized before the A.A.P.G. district was designated. Most of the societies are officially affiliated with the A.A.P.G., and most of their members are members of the A.A.P.G., but the societies have



A.A.P.G. DISTRICTS

FIG. 1

THE ASSOCIATION ROUND TABLE

ASSOCIATION DISTRICTS

(May 1, 1944)

<i>District</i>	<i>Representatives</i>	<i>Members</i>	<i>Associates</i>	<i>Total Membership</i>
1. Amarillo.....	1	17	8	25
2. Appalachian.....	1	126	25	151
3. Canada.....	1	43	14	57
4. Capital.....	1	93	21	114
5. Corpus Christi.....	1	55	10	65
6. Dallas.....	1	114	31	145
7. East Oklahoma.....	3	280	42	322
8. Fort Worth.....	1	85	23	108
9. Great Lakes.....	2	156	84	240
10. Houston.....	4	364	86	450
11. Michigan.....	1	37	11	48
12. New Mexico.....	1	28	9	37
13. New York.....	1	120	35	164
14. Pacific Coast.....	4	387	137	524
15. Rocky Mountain.....	1	115	42	157
16. Shreveport.....	1	87	36	123
17. South America.....	1	116	36	152
18. Southeast Gulf.....	1	71	33	104
19. Southern Louisiana.....	1	89	37	126
20. Southern Permian Basin.....	1	143	50	193
21. South Texas.....	1	135	39	174
22. Tyler.....	1	39	10	49
23. West Oklahoma.....	1	159	51	210
24. Wichita.....	1	143	57	200
25. Wichita Falls.....	1	38	18	56
Total.....	34	3,049	945	3,994

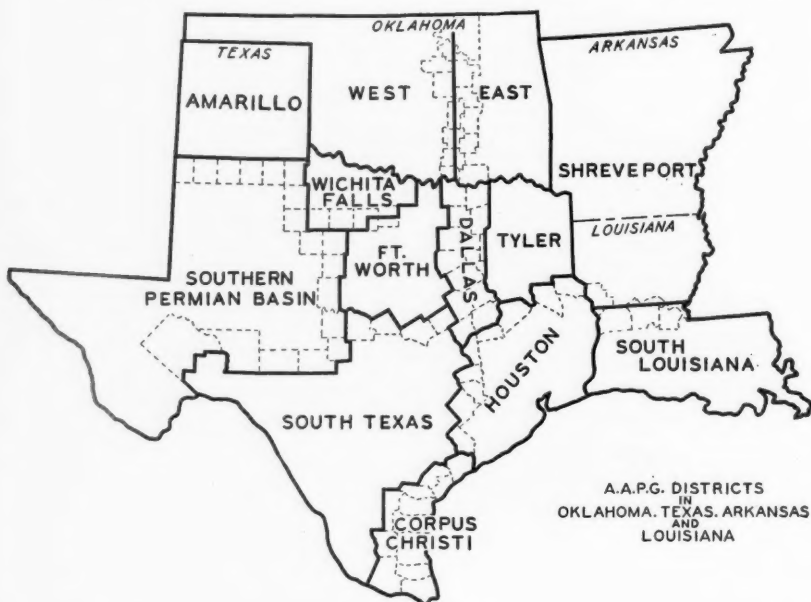


FIG. 2

no officially recognized voice in Association business. The societies and the Association are affiliated by the ties of common scientific purposes, professional activities, and membership.

GEOGRAPHIC DESCRIPTION OF DISTRICTS

Amarillo.—Panhandle of Texas. Its south boundary coincides with south line of these counties: Parmer, Castro, Swisher, Briscoe, Hall, and Childress.

Appalachian.—Ohio, West Virginia, western New York, western Pennsylvania, eastern Kentucky, and eastern Tennessee. Northeast boundary in New York coincides with east sides of Oswego, Onondago, Cortland, and Tioga counties; in Pennsylvania it coincides with east and south sides of Bradford, Sullivan, Lycoming, Clinton, Center, Mifflin, Huntingdon, and Bedford counties. Southwest boundary in Kentucky is north-south line west of Louisville; in Tennessee, it is north-south line west of Nashville.

Canada.—All of Canada.

Capital.—Delaware, Maryland, District of Columbia, Virginia, and North Carolina.

Corpus Christi.—Southern Gulf Coast of Texas. Includes counties of Calhoun, Refugio, Aransas, San Patricio, Jim Wells, Nueces, Kleberg, Brooks, Kenedy, Hidalgo, Willacy, and Cameron.

Dallas.—Texas counties of Grayson, Fannin, Collin, Hunt, Dallas, Rockwall, Kaufman, Ellis, Navarro, Limestone, Freestone, Leon, Robertson, west part of Van Zandt and Henderson west of north-south line drawn from southeast corner of Hunt County to south boundary of Henderson County. (This places Canton and Athens in Tyler district).

East Oklahoma.—Oklahoma east of north-south range line between R. 6 E. and R. 7 E. (thus including Pawhuska, Cleveland, Oilton, Drumright, Bristow, Wewoka, Holdenville, Wapanucka, and Durant).

Fort Worth.—Texas counties of Cooke, Denton, Wise, south part of Jack to include Jacksboro, southeast part of Young to include Graham, Stephens, Palo Pinto, Parker, Tarrant, Johnson, Hood, Somervell, Erath, Eastland, Brown, Comanche, Mills, Hamilton, Bosque, Hill, McLennan, and Coryell.

Great Lakes.—States of Minnesota, Wisconsin, Iowa, Illinois, Indiana, Missouri, Kentucky west of Louisville, and Tennessee west of Nashville.

Houston.—Southeastern Texas Coastal Plain counties extending from the Gulf of Mexico on the southeast to and including the following counties on the north and west: Shelby, Nacogdoches, Angelina, Houston, Madison, Brazos, Washington, Austin, Colorado, Jackson, and Matagorda.

Michigan.—State of Michigan.

New Mexico.—Arizona and New Mexico.

New York.—New England states, New Jersey, eastern New York, and eastern Pennsylvania. West boundary in New York coincides with west sides of Jefferson, Lewis, Oneida, Madison, Chenango, and Broome counties; in Pennsylvania it coincides with west or north sides of Susquehanna, Wyoming, Luzerne, Columbia, Montour, Northumberland, Union, Snyder, Juniata, Franklin, and Fulton counties.

Pacific Coast.—Washington, Oregon, Nevada, and California.

Rocky Mountain.—Montana, Idaho, Wyoming, Utah, and Colorado.

Shreveport.—Arkansas and northern Louisiana north of Township 4 North. (This places Alexandria in Southern Louisiana).

South America.—All of South America.

Southeast Gulf.—Mississippi, Alabama, Georgia, South Carolina, and Florida.

Southern Louisiana.—Southern Louisiana south of north side of Township 4 North, to include Alexandria.

Southern Permian Basin.—Western Texas extending east from the Rio Grande and New Mexico to and including the following counties: Brewster, Pecos, Crockett, Sutton, Kimble, Mason, McCulloch, Coleman, Callahan, Shackelford, Jones, Stonewall, King, Cottle, Motley, Floyd, Hale, Lamb, and Bailey.

Southern Texas.—Southern Texas extending northeast from the Rio Grande to and including the following counties: Terrell, Val Verde, Edwards, Kerr, Gillespie, Llano, San Saba, Lampasas, Bell, Falls, Milam, Burleson, Lee, Fayette, Lavaca, Victoria, Goliad, Bee, Live Oak, Duval, Jim Hogg, and Starr.

Tyler.—Northeastern Texas extending south and west of the state boundary to and including the following counties: Lamar, Delta, Hopkins, Rains, eastern Van Zandt to include Canton, eastern Henderson to include Athens, Anderson, Cherokee, Rusk, and Panola.

West Oklahoma.—Oklahoma west of north-south range line between R. 6 E. and R. 7 E. (thus including Ponca City, Pawnee, Cushing, Chandler, Shawnee, Seminole, Ada, Ardmore, Madill).

Wichita.—North Dakota, South Dakota, Nebraska, and Kansas.

Wichita Falls.—Counties of Hardeman, Foard, Wilbarger, Wichita, Clay, Montague, Knox, Baylor, Archer, Haskell, Throckmorton, Young except southeast corner (thus placing Graham in the Fort Worth district), and Jack north of Jacksboro.

MEMORIAL

ROY ERNEST DICKERSON
(1877-1944)

The sudden death of Dr. Roy E. Dickerson came as a shock to his many friends and acquaintances throughout the oil industry. He died in New York on February 24, 1944,



Bachrach

ROY ERNEST DICKERSON

after suffering a heart attack in the Grand Central Station. Dr. Dickerson had been attending the meetings of the American Institute of Mining and Metallurgical Engineers and until the time of his death had apparently been in good health.

Dr. Dickerson was born, August 8, 1877, in Monticello, Illinois, a son of Merritt Michael and Martha Gilmore Dickerson. He received his early education at San Jose, California, where his mother had moved, following his father's death at Thomasville, Georgia. He graduated from the Berkeley (California) High School in 1896 with expectation of following a career in science. He worked his way through college and in 1900 received the degree of Bachelor of Science from the University of California, the degree of Master of Science in 1910, and Doctor of Philosophy in 1914. His graduate work under Dr. J. C. Merriam stimulated his primary scientific interest in paleontology. From 1910 to 1918 he taught physics, chemistry, mathematics, biology, physiography, paleontology, and geology in California high schools and the University of California. In 1910 he also became a part-time curator, department of paleontology, California Academy of Sciences and in 1914 was appointed assistant curator, advancing to curator in 1917 and honorary curator in 1919.

From 1912 to 1918 he was a consulting geologist for various private petroleum interests and in 1918 he gave up teaching to accept a position as petroleum geologist for the Standard Oil Company of California, later rising to geological superintendent in the Philippine Islands. In 1926 he was employed as geologist for The Atlantic Refining Company, working at first in Maracaibo, Venezuela, and later in various parts of Central America, South America, Cuba, and Haiti. In 1936 he became chief geologist of foreign producing operations. He retired from The Atlantic Refining Company in August, 1942, at the age of 65, and accepted the post as chief of the technical section of the Petroleum Division, Foreign Economics Administration of the Federal Government.

Dr. Dickerson was a member of Sigma Xi; associate editor (geology), *Philippine Journal of Science*, 1920-1925; member, Philippine Earthquake Commission; member, Seismological Society; member, *Derde Nederlandsch-Indisch Natuurwetenschappelijk Congres*; member, American Association of Petroleum Geologists, American Association for the Advancement of Science, American Institute of Mining and Metallurgical Engineers, Paleontological Society, and Geological Society of America.

He is survived by Mrs. Dickerson, the former Miss Delle Howard of Cloverdale, California, whom he married on July 14, 1904. The Dickersons lived at 1305 North Adams Street, Arlington, Virginia.

Dr. Dickerson was an avid reader and one of his outstanding characteristics was his ability to absorb geologic information and to add to the wide range of it with which he was familiar. Although his primary interest was the study of paleontology, his broad acquaintance with general geologic literature and personal knowledge of many areas throughout the world enabled him to visualize and demonstrate to his associates many of the broader aspects of geologic science.

An ardent scientist and teacher at heart, Dr. Dickerson in his early studies contributed much to the development of California stratigraphy and nomenclature. His intense interest in science permitted him to perceive and publish interesting and constructive side-lights to his necessary largely unpublished geological studies. This, coupled with his interest in people and his ability to make friends wherever he went, serves to keep his memory alive. He will be missed by all who knew him and the memory of his genial character and the aid which he has given to many will remain as a testimonial to a life well spent.

RICHARD C. HARRIS

April 24, 1944

GEORGE L. RICHARDS, JR.
(1908-1944)

George L. Richards, Jr., passed away on March 20, 1944, at the Huntington Memorial Hospital, Pasadena, California, after a prolonged illness. George was born on February 16,

1908, in Los Angeles. He attended grammar schools and high school in Los Angeles and matriculated at Stanford University in 1927, from which he was graduated with an A.B. degree in 1931 and an M.A. degree in 1932. He pursued his studies in geology and paleontology as a graduate student at the California Institute of Technology, Pasadena, in 1934 and 1935.

It was during his university career that George, in collaboration with his brother, L. W. Richards, published a booklet entitled "Geologic History at a Glance," which created considerable interest because of the unique manner of presentation. In this booklet the geologic time scale was illustrated on plates in such a manner that the sketch of the geologic column was connected with photographs illustrating the various geologic strata.

George was interested in all phases of the geological sciences. He had made a specialty however, of photogeology and was particularly skillful in the interpretation of geologic structure from the study of aerial photographs. He maintained his keen interest in geology throughout his illness. It became an absorbing hobby with him during the period when ill health prevented active pursuit of his profession, and he kept in touch with all of the current geological publications and activities which his strength would permit. He was a member of the American Association of Petroleum Geologists, Sigma Xi, and Paleontological Society of America.

George joined the geological department of the Shell Oil Company, Incorporated, on January 1, 1935, and during the succeeding years worked in California, Texas, and the Rocky Mountain states.

He is survived by his wife, Mrs. Harriet Richards of San Marino, his parents, Mr. and Mrs. George L. Richards of Altadena, California, and one brother, L. W. Richards, consulting geologist, Los Angeles.

In his untimely passing at the age of 36 years, the geological fraternity has lost a sincere and faithful member, one whose natural friendliness, modesty, and enthusiastic interest in his professional work will long be remembered by his many friends and associates.

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M. G. EDWARDS

Los Angeles, California
May, 1944

AT HOME AND ABROAD

CURRENT NEWS AND PERSONAL ITEMS OF THE PROFESSION

J. F. GALLIE has resigned from the Petroleum Administration for War, Washington, D. C., to accept a position as senior geologist for the Arkansas Oil and Gas Commission, with offices at 409-415 First National Bank Building, El Dorado, Arkansas. Gallie remains as business manager of the Society of Exploration Geophysicists, whose address is now Box 410, El Dorado, Arkansas.

GEORGE M. CUNNINGHAM has been promoted from chief geologist to manager of exploration for the Standard Oil Company of California, at San Francisco.

The following members of the executive committee of the Alberta Society of Petroleum Geologists were elected at Calgary, Alberta, Canada, for the new administrative year: president, D. B. LAYER, McColl-Frontenac Oil Company; vice-president, J. D. WEIR, The California Standard Company; business manager, H. D. CURRY, Shell Oil Company of Canada, Ltd.; secretary-treasurer, IAN M. COOK, British American Oil Company, 209-6th Avenue West, Calgary, Alberta.

Lieutenant Colonel O. F. KOTICK, GSC, formerly geologist with the Tide Water Associated Oil Company, and Lieutenant Colonel DREXLER DANA, GSC, with the Richfield Oil Corporation as manager of geophysical exploration, are now in England. Their address is A.P.O. 655, c/o Postmaster, New York.

The following officers of the Shawnee Geological Society, Shawnee, Oklahoma, were elected at a noon luncheon on May 12, for 1944-1945: president, ROY D. MCANINCH, Stanolind Oil and Gas Company, Box 1099; vice-president, E. R. OWEN, Phillips Petroleum Company, Box 152; secretary-treasurer, MARCELLE MOUSLEY, Atlantic Refining Company, Box 169.

PHILLIP MAVERICK, petroleum geologist for the Fort Worth Regional Office of the Securities and Exchange Commission for the past 6 years, has been transferred to Tulsa, where he will serve the Commission in a like capacity at its field office, 621 Wright Building.

SIDNEY A. PACKARD, formerly with the Arkansas Fuel Oil Company, Shreveport, Louisiana, is with DeGolyer and MacNaughton, 1000 Continental Building, Dallas, Texas.

JOHN KELLY, formerly with the Ohio Oil Company, is with the American Republic Corporation, Milam Building, San Antonio, Texas.

THOMAS J. ETHERINGTON has changed his address from the Richmond Petroleum Company of Colombia, at Bogota, to 3163 West Laurelhurst Drive, Seattle, Washington.

H. A. IRELAND, of the United States Geological Survey, Norman, Oklahoma, talked on "The Regional Correlation of the Arbuckle Limestone," before the Oklahoma City Geological Society, May 11.

HENRY CARTER REA has resigned his position with the British American Oil Producing Company at Calgary, Alberta, to open a consulting office at Denver, Colorado.

RUSSELL S. TARR, consulting geologist of Tulsa, Oklahoma, is a major in the Army Air Corps at Washington, D. C.

Lieutenant Colonel OLIN G. BELL has retired to the reserve list of Army officers and will resume his duties with the Humble Oil and Refining Company. His address is 5519 Jackson Street, Houston, Texas. Bell is a veteran of World War I. For the past 2 years he has been base intelligence officer, director of supply and maintenance, and base executive officer at Peterson Field, Colorado Springs, Colorado.

EDWARD L. CLARK, professor of geology at Drury College, Springfield, Missouri, has been made State geologist of Missouri, succeeding the late H. A. Buehler.

W. S. W. KEW, of the geological staff of the Standard Oil Company of California at Los Angeles for many years, was appointed chief geologist of the company, effective May 1, with offices at 225 Bush Street, San Francisco.

A. RODGER DENISON, chief geologist of the Amerada Petroleum Corporation, Tulsa, spoke before the Southeastern Section of the A.I.M.E., Birmingham, Alabama, April 28, on the subject of "Oil—Its Geographical and Geological Distribution in the World."

J. V. HOWELL, 912 Philtower Building, was elected president; W. H. BUTT, of the Atlantic Refining Company, vice-president; W. REESE DILLARD, of the Norbla Oil Company, second vice-president; L. C. CASE, of the Gulf Oil Corporation, secretary-treasurer; and R. L. GINTER, of the United States Geological Survey, editor, of the Tulsa Geological Society, Tulsa, Oklahoma, May 15, at the last regular meeting of the season. The following were elected to the council of the society: WILLIAM H. ELSON, Beacon Building, Tulsa; WALTER E. HOPPER, National Mutual Building, Tulsa; and ROBERT L. KIDD, Cities Service Oil Company, Bartlesville, Oklahoma.

MAJOR RUAL B. SWIGER, of Corpus Christi, Texas, has been retired from active duty in his second war after 18 months in the South Pacific.

JOSEPH E. POGUE, vice-president of the Chase National Bank, New York, addressed the Mississippi Bankers Association in annual meeting at Biloxi, Mississippi, May 16. His subject was "The Rôle of Mississippi in the World of Oil."

JOHN N. DAHM is junior geologist with the Union Mines Development Corporation, 404 First National Bank Building, Grand Junction, Colorado.

FRANK WALKER JOHNSON, of the Standard Oil Company of Venezuela at Barcelona, has been transferred to the Creole Petroleum Corporation at Maracaibo, Venezuela, to take over the duties of division geologist of the western division, replacing A. J. FREIE, who has been transferred to the Caracas office.

LAWRENCE J. BECKMANN, recently with the Creole Petroleum Corporation at Caripito, Venezuela, has returned to the United States. His address is Garland, Nebraska.

EARL E. FRY, recently with the Cities Service Oil Company at Jackson, Mississippi, is with the Pan American Production Company, Mellie Esperson Building, Houston, Texas.

ROBERT M. KLEINPELL is a civilian internee at the Japanese Los Banos Camp in the Philippines. His home address is 1278 Mar Vista Avenue, Pasadena, California.

A. E. BARNES, JR., formerly with the Ohio Oil Company, Midland, Texas, may be addressed at 1611 West Indiana Street, Midland.

LIEUTENANT JACK W. DAVIES, formerly with the Halliburton Oil Well Cementing Company, Wichita Falls, Texas, is operations officer for the Canol Project at Norman Wells, North West Territories, Canada.

P. HASTINGS KELLER has resigned his position as assistant State geologist of Indiana, and has returned to Detroit, Michigan, to engage in independent oil work with the Mogul Oil Company.

DISTINGUISHED LECTURE TOUR

The final lecture tour of the 1943-44 season, sponsored by the distinguished lecture committee, brought Dr. Gayle Scott, professor of geology at Texas Christian University, before a representative group of affiliated societies. Dr. Scott discussed the importance of certain types of fossils in indicating specialized conditions of environment and sedimentary deposition, based on his years of stratigraphic and paleontological study in Texas. His subject was "Stratigraphic Correlations and Depositional Environments Indicated by Ammonoid Occurrences in the Texas Pennsylvanian." In addition to delivering the lecture, Dr. Scott also used this opportunity to greet the members in his new capacity as editor of the Association.

In the course of the tour he visited the following societies.

- May 15 Tulsa Geological Society at Tulsa
- 16 Oklahoma City Geological Society at Oklahoma City
- 17 Dallas Petroleum Geologists at Dallas
- 18 Houston Geological Society at Houston
- 19 Mississippi Geological Society at Jackson
- 22 West Texas Geological Society at Midland
- 23 Panhandle Geological Society at Amarillo
- 24 North Texas Geological Society at Wichita Falls

JOHN L. FERGUSON, *chairman*

PAN AMERICAN INSTITUTE OF MINING ENGINEERING AND GEOLOGY—UNITED STATES SECTION

(Press release from Dean Edward Steidle, Pennsylvania State College)

The First Pan American Congress of Mining Engineering and Geology, organized and directed by the Institute of Mining Engineering of Chile and officially authorized by the Government of Chile and the South American Union of Engineering Associations, was held in Santiago, Chile, January 15 to 23, 1942. The A.I.M.E. appointed several delegates to this Congress including Edward Steidle and Will Wright. Mr. Wright was selected to head the group and prepared the report on the meetings which was published in *Mining and Metallurgy* of March, 1942. Our Government appointed D. F. Hewett to represent the Geological Survey, Elmer Pehrson the Bureau of Mines, and Will Wright the State Department. Edward Steidle represented the Commonwealth of Pennsylvania.

At this Congress it was decided to organize a Pan American Institute of Mining Engineering and Geology (PAIMEG) with headquarters in Santiago, Chile. National sections have been organized in Argentina, Bolivia, Brazil, Chile, Peru, and Uruguay. This organization naturally wanted the support of the A.I.M.E. and at the February meeting, 1943, at a meeting of the Board, Mr. Albala, the General Secretary of PAIMEG, discussed the object of the organization and their desire for our support. Dr. Mathewson, president, selected a committee to study the matter and after various discussions with the committee as to just what A.I.M.E. would and could do, the decisions were finally published in the December, 1943, issue of *Mining and Metallurgy*.

The first Congress embraced 14 sections, representing every branch of the mineral industries. Perhaps the most important result of the Congress was the mutual recognition by the representatives of all nations that the Americas face a common problem of defense in the present emergency and possibly even more serious social and economic readjustments in the post-war years. Therefore, recommendations were made by resolution of the Congress with the intention of establishing good-neighbor policies with respect to minerals on a firm basis.

PAIMEG desires to cooperate with all the mineral industries societies of the Americas, support all activities that will benefit the mineral industries, and expand fundamental knowledge of geological conditions and encourage the standardization of technical terminology. The Institute will also facilitate the interchange of publications, students, professional men, and industrialists connected with the mineral industries.

An annual meeting of the members of PAIMEG will be held in conjunction with that of the February meeting of the A.I.M.E. in New York and a program of papers will be presented on mining, metallurgical, and geological subjects in Latin American countries.

PAIMEG is proposed as an autonomous private institution independent of the governments of the Americas. Qualified candidates from commercial organizations, societies, universities, et cetera, which are closely related to the mineral industries are accepted as members. PAIMEG wishes to organize through the initiative of individuals and private interests without having the necessity, for the time being, of asking help of the governments concerned.

At the annual A.I.M.E. meeting last February Mr. Wright met with president Mathewson, secretary Parsons, Edward Steidle, and D. F. Hewett and they discussed the possibilities of organizing a national section of PAIMEG in the United States. At Mr. Parsons' suggestion, it was decided to hold an initial meeting in New York on April 19, at the time of the regular A.I.M.E. Board meeting. Edward Steidle was asked to serve as chairman of the "steering committee" in accordance with a request from president Rodriguez, PAIMEG, under date of November 10, 1943. A second Congress is scheduled to be held in Rio de Janeiro, Brazil, in October, 1944, but will no doubt be postponed for the duration. Future Congresses will be sponsored by PAIMEG.

Chairman Steidle invited 70 men, principally of New York and Washington, who have had some personal contact with the Latin Americas, to attend a steering committee meeting in New York on April 17. He received 43 acknowledgments of which 38 offered to join immediately. Seven additional men sent word indirectly that they would join. Eighteen men reported for the steering committee meeting.

The consensus of the steering committee was that it was most desirable that a National Section of PAIMEG be formed in the United States without further delay. A motion establishing the Section carried unanimously. Upon proper nomination and vote, the following were elected as a national directorate.

Chairman	Edward Steidle, Dean, School of Mineral Industries, The Pennsylvania State College
Vice-Chairman	C. W. Wright, Chief Foreign Minerals Specialist, United States Bureau of Mines
Sec'y-Treas.	A. T. Ward, Mining Engineer, New York City
Directors	D. F. Hewett, In Charge, Section of Metalliferous Deposits, United States Bureau of Mines
	M. B. Gentry, Vice President, Freeport Sulphur Company, New York City
	T. T. Read, School of Mines, Columbia University
	W. E. Milligan, Department of Metallurgy, Yale University

Members of any mineral industries society in the United States and Canada are eligible to join the National Section. Individuals paying 1944 dues, amounting to five dollars (no initiation fee) before December 31, 1944, will be recorded as Charter Members. The chairman was requested to make this known to interested people through the medium of the various publications in the field of the mineral industries, including societies and other technical organizations. At this stage, membership must be based on willingness to aid in fostering good will and better understanding among mineral industries engineers and technologists in the Western Hemisphere. Anyone interested in joining PAIMEG as a charter member is requested to forward dues to Edward Steidle, Chairman, National Directorate, PAIMEG, State College, Pennsylvania, or to Arthur T. Ward, Secretary-Treasurer, National Directorate, PAIMEG, 50 Church Street, New York City. Minutes of the organization meeting will be forwarded to all members.

CHARLES A. RENFROE has left the Phillips Petroleum Company to accept a position with the Superior Oil Company, Midland, Texas.

S. B. HENRY, of the Richmond Petroleum Company of Colombia, has returned from Bogota to the Standard Oil Company of California, San Francisco.

J. BRIAN EBY discussed "Germany's Oil," at the luncheon meeting of the Houston Geological Society, June 1.

HAROLD VANCE, of the Texas A. & M. College department of petroleum engineering, talked on "Engineering Study of Lafitte Oil Field, Louisiana," at the luncheon meeting of the Houston Geological Society, June 15.

JOHN W. STOVALL, of the geology faculty at the University of Oklahoma, Norman, spoke before the Oklahoma City Geological Society, June 1, on "Oklahoma a Thousand Years Hence."

EDWIN V. VAN AMRINGE, assistant professor of geology at Pasadena Junior College, Pasadena, California, has an article, "Geology as a Chapter in the Art of War," in *Frontiers* a collection of chapters on contemporary science by members of the Physical Science Faculty of Pasadena Junior College. Van Amringe also edited the booklet of 47 pages.

The United States Geological Survey has established a new office in Great Falls, Montana, that will be known as the northwestern regional office, Mineral Classification Division, Conservation Branch. It will handle Mineral Classification Division matters in the states of North Dakota, Montana, northern Idaho, and Washington. CHARLES E. ERDMANN has been transferred from Denver to Great Falls to assume charge of this office.

W. B. EMERY is vice-president and manager of the production department of the Ohio Oil Company. He is in charge of exploration and development.

R. V. HOLLINGSWORTH, geologist, formerly of the Shell Oil Company, Inc., opened a Paleontological Laboratory, on May 1, at Midland, Texas. The Laboratory will specialize on work with the fusulines. Various microscopical services will be available to subscribers. HAROLD WILLIAMS, now at the University of Kansas, will join the Laboratory on July 1.

HARVEY M. LYTEL has changed his address from Cairo, Egypt, to the Socony-Vacuum Oil Company's office at 26 Broadway, New York.

A. E. BARNES, formerly with the Ohio Oil Company, is in the employ of the Skelly Oil Company at Midland, Texas.

R. B. WHEELER, of The Texas Company at New Orleans, Louisiana, has been transferred to the Texas Petroleum Company, Bogota, Colombia.

WALTON SUMNER is with the Socony-Vacuum Oil Company in Lima, Peru.

MAX L. KRUEGER, of the Union Oil Company of California, is assembling an exploratory organization of which he is chief geologist for the Rocky Mountain division, with headquarters at 162 North Third Street, Laramie, Wyoming.

O. A. SEAGER, recently assistant division manager of the Carter Oil Company in the northwest division, Billings, Montana, is now assistant manager of the Standard Oil Company of Egypt, at Cairo.

FIELD CONFERENCE

HOBACK BASIN-HOBACK RANGE-GROS VENTRE RANGE-JACKSON HOLE REGION

August 12 and 13, 1944

The staff of Camp Davis, the University of Michigan Field Station in the Rocky Mountains, will conduct a field conference on the geology of the Camp Davis region, Saturday and Sunday, August 12 and 13. The results of unpublished research in the past 3 years, especially in the fields of structure and stratigraphy, will be reviewed. The relation of the Hoback Basin to the Gros Ventre and Hoback ranges will be the point of principal interest. The Hoback Basin is the north end of the Green River Basin. Cabins and meals for 20 to 30 persons will be available at Camp Davis. If more than that number attend accommodations will be found in Jackson, Wyoming, 18 miles distant. A lecture and discussion session at Camp Davis, preliminary to the field excursions, is planned for Friday evening, August 11. Those who decide to come, please communicate with A. J. EARDLEY, Department of Geology, University of Michigan, Ann Arbor, Michigan. After July 1, write him at Camp Davis, Jackson, Wyoming.

CHARLES C. WILLIAMS, formerly with the National Geophysical Company, is now associated with the General Geophysical Company. He may be addressed in care of this company, 2513-14 Gulf Building, Houston 2, Texas.

The South Louisiana Geological Society on May 9 held its meeting in Lafayette. H. N. FISK, Louisiana State University, Baton Rouge, talked on "The Geological History of the Alluvial Valley of the Lower Valley of the Lower Mississippi River." On May 22 at a special meeting in Lake Charles, S. G. GRAY, Tide Water Associated Oil Company, Houston, Texas, delivered a paper on "The Erath Field"; co-authors of the paper are M. H. STEIG, J. K. NIEWLES, J. B. WHARTON, and R. L. DENHAM. At the final meeting of the spring session, on June 5, M. M. SLOTNICK, of the Humble Oil and Refining Company, Houston, talked on, "Physical Concepts Underlying Gravimetric and Seismic Prospects." The Society's president, C. B. ROACH, of the Shell Oil Company, Lake Charles, has been absent since early April on a business trip to the British Isles.

LOUIS DESJARDINS, aero-geologist of Tulsa, Oklahoma, after completing a quarter-term assignment as research associate in geological engineering at Princeton University, has been employed as aero-geologist by the Creole Petroleum Corporation, Caracas, Venezuela.

LAWRENCE VANDER LECK, of Altadena, California, has resigned his position of director of Production in District 5 for the Petroleum Administration for War. He will engage in business as a petroleum consultant.

BASIL B. ZAVOICO, for several years connected with the Chase National Bank of New York, and recently with the Petroleum Administration for War in Washington, D. C., announces the opening of offices for consulting practice in petroleum geology and engineering at 220 East 42d Street, New York 17, New York.

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Meetings: Dinner and business meetings third
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geologists are welcome.

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to May, inclusive, 7:30 P.M., Criminal Courts
Room, Caddo Parish Court House. Special meetings
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Michigan Geological Survey,
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Meetings: Bi-monthly from November to April at
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U. S. Geological Survey

Meetings: First and third Mondays, each month, from October to May, inclusive, at 8:00 P.M., University of Tulsa, Kendall Hall Auditorium. Luncheons: Every Tuesday (October-May), Bradford Hotel.

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Luncheons: Every Monday at 12:00 noon, Blackstone Hotel

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Regular meeting held the first and third Thursdays at noon (12 o'clock), Mezzanine floor, Texas State Hotel. For any particulars pertaining to the meetings write or call the secretary.

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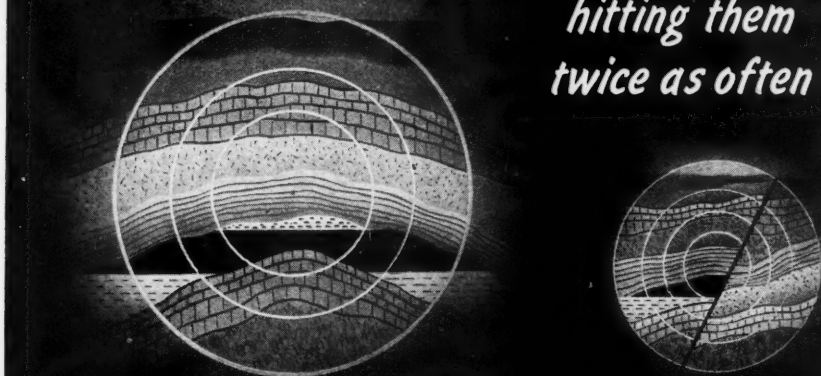
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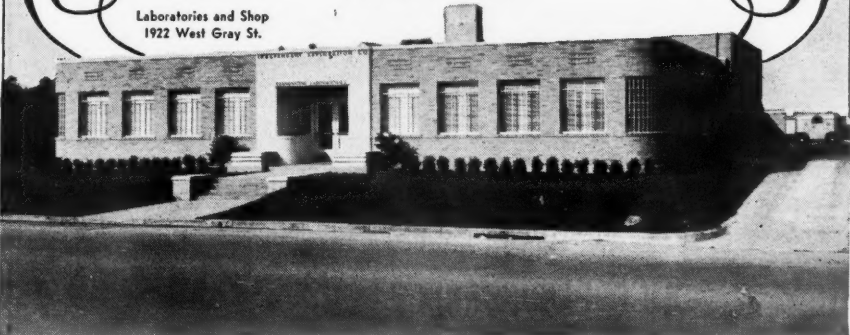
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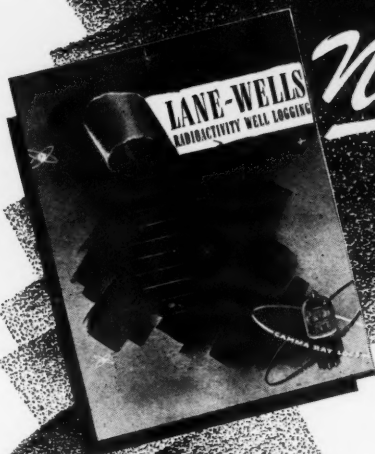
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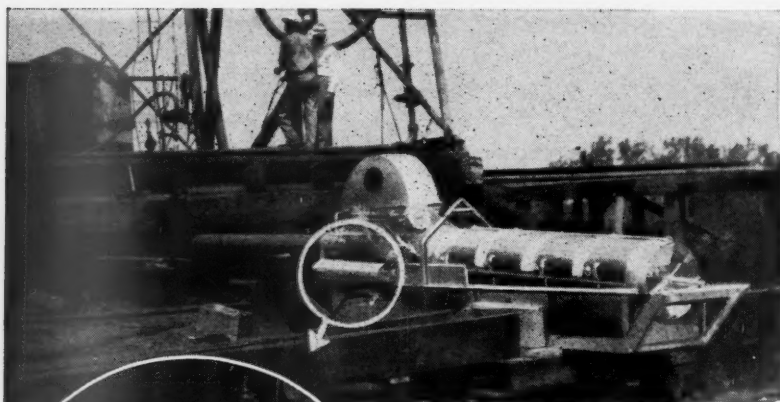
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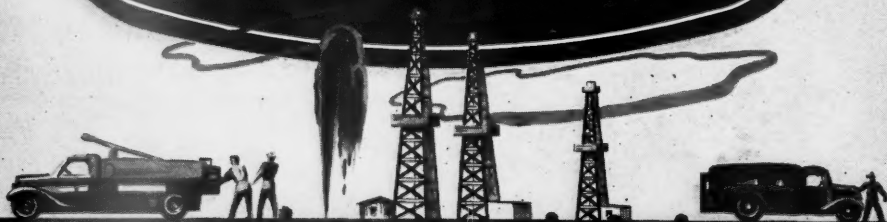
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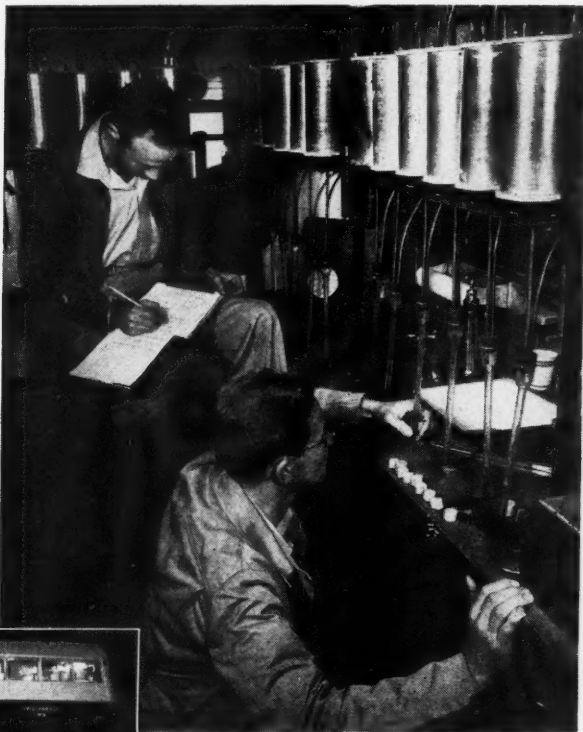
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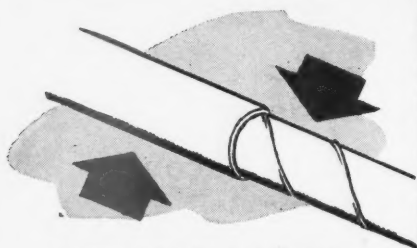
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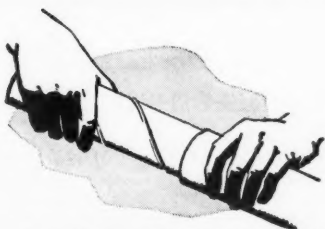


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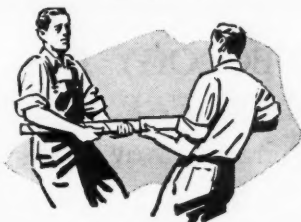
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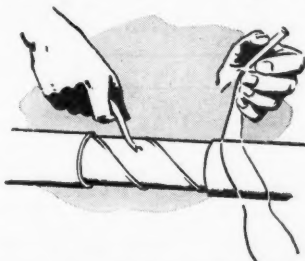


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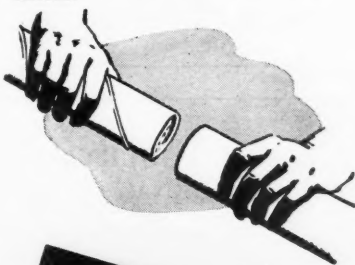
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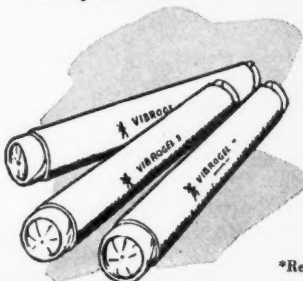
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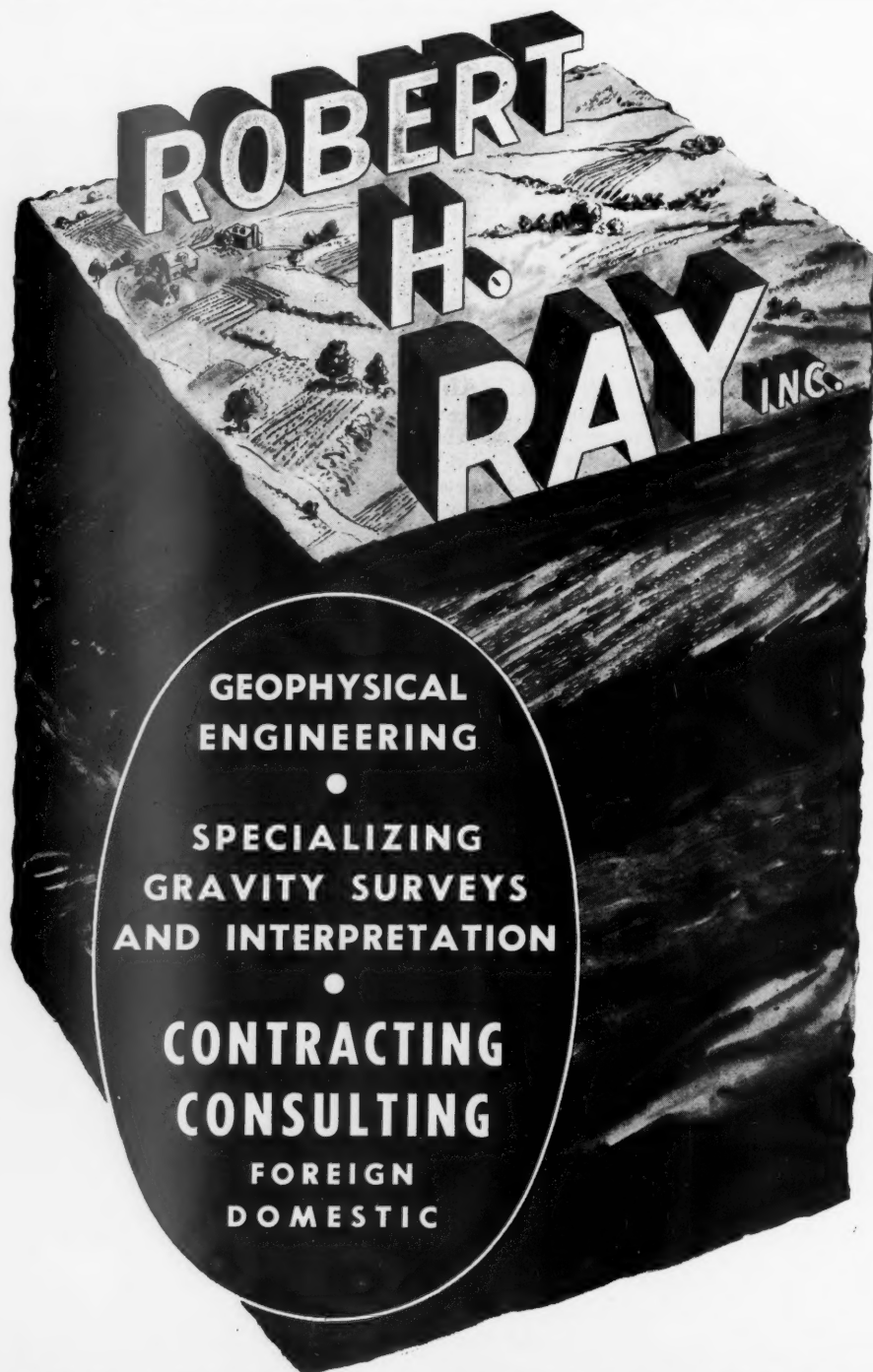
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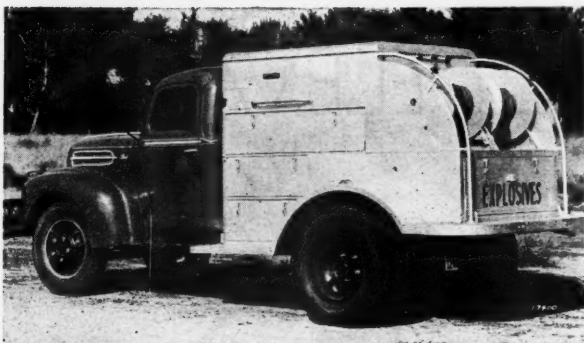
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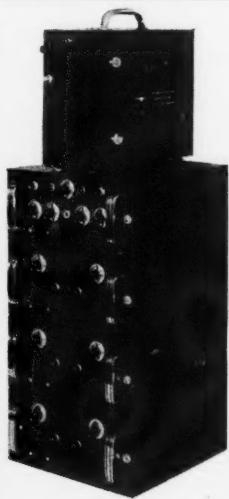
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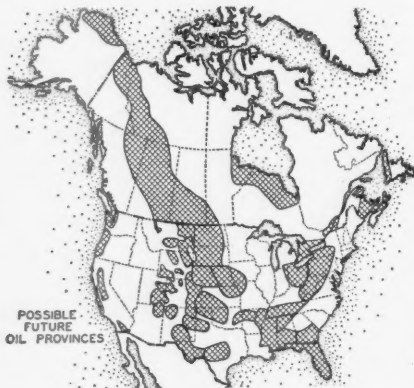
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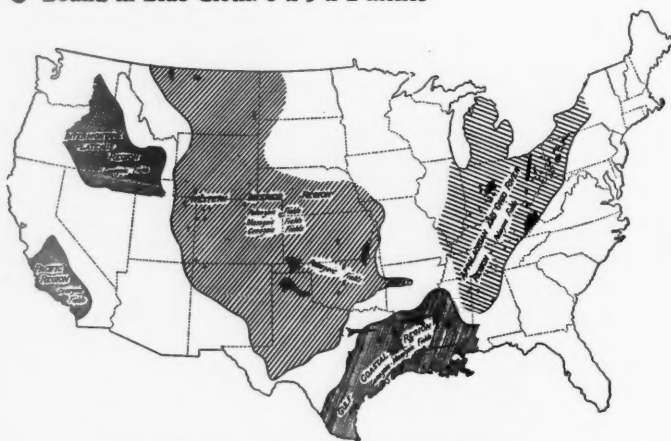
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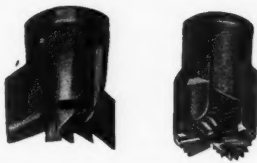
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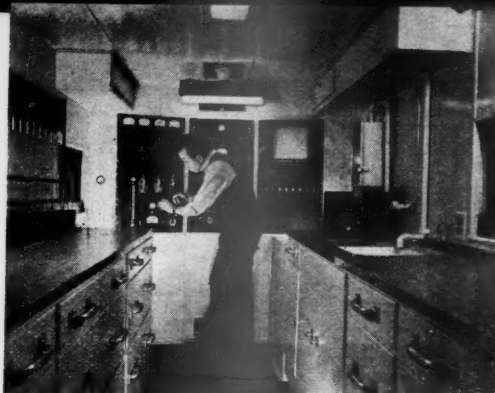


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